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WORK PLAN AND ENVIRONMENTAL IMPACT STATEMENT FOR WATERSHED PROTECTION AND FLOOD PREVENTION KICKAPOO NATIONS WATERSHED

Oklahoma and Lincoln Counties, Oklahoma



PREPARED UNDER THE AUTHORITY OF THE WATERSHED PROTECTION
AND FLOOD PREVENTION ACT
(PUBLIC LAW 566, 83rd CONGRESS, 68 STAT. 666), AS AMENDED

Kickapoo Nations Conservancy District
Lincoln County Conservation District
Oklahoma County Conservation District
City of Chandler
Lincoln County Commission
Oklahoma County Commission

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE

AUGUST 1977

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FINAL PLAN AND ENVIRONMENTAL IMPACT STATEMENT

KICKAPOO NATIONS WATERSHED

Oklahoma and Lincoln Counties, Oklahoma

August 1977

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Prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended (16 USC 1001-1008) and in accordance with Section 102(2)(C) of the National Environmental Policy Act of 1969, Public Law 91-190, as amended (42 USC 4231 et seq).

Prepared by: Kickapoo National Conservancy District
Lincoln County Conservation District
Oklahoma County Conservation District
City of Chandler
Lincoln County Commission
Oklahoma County Commission
U.S. Dept. of Agriculture, Soil Conservation Service
U.S. Dept. of Agriculture, Forest Service

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FINAL PLAN 1/

KICKAPOO NATIONS WATERSHED

Oklahoma and Lincoln Counties, Oklahoma

August 1977

1/ All information and data, except as otherwise noted, were collected during watershed planning investigations by the SCS, USDA.

ADDENDUM

Kickapoo Nations Watershed, Oklahoma

This addendum shows the project costs, benefits, and benefit-cost ratio based on 6-5/8 percent interest rate, 1976 installation costs, and current normalized prices (7-26-76) for agricultural commodities. Annual project costs, benefits, and benefit-cost ratio are as follows:

1. Project costs are \$516,173.
2. Project benefits are \$880,433.
3. The project benefit-cost ratio is 1.7:1.

PREFACE

Enclosed are two documents -- the Plan and the Environmental Impact Statement for Kickapoo Nations Watershed, Oklahoma.

The plan has been developed by the local sponsors with the assistance of the U. S. Department of Agriculture and is the basis for the authorization of federal assistance to implement the proposed project in accordance with the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended (16 USC 1001-1008).

The Environmental Impact Statement has been prepared by the U. S. Department of Agriculture in compliance with Section 102(2)(C) of the National Environmental Policy Act of 1969, Public Law 91-190, as amended (42 USC 4321 et seq).

The Environmental Impact Statement contains the detailed information on project area, planned project, problems, impacts, alternatives, resource use, and various appendices.

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SUMMARY

The watershed, about 165,300 acres in central Oklahoma, contains the rural population centers of Chandler, Luther, Wellston, and Warwick, and is located northeast of Oklahoma City. This watershed is composed of eight named and several unnamed tributaries to the Deep Fork River. Land uses are agriculture related.

Annual erosion rates generally range from 1 to 5 tons per acre with the exception of about 2,138 acres of critical areas which range from 5 to 15 tons. Flooding affects 6,515 acres during the 100-year flood. Sediment deposition has affected 2,150 acres of floodplain and scour 470 acres. This has resulted in monetary damages, reduced yields, and environmental degradation. Water-based recreation opportunities are needed. The City of Chandler is in need of a future water supply.

Goals are to reduce erosion to a rate consistent with land use; provide a 3-5 year level of protection; reduce flood, sediment, and scour damages on the main floodplain areas; to provide water to meet Chandler's demand by the year 2005; to provide water-based recreation opportunities, and to minimize damages to archeological and historical, fish and wildlife, and similar environmental resources.

This plan provides for land treatment and structural measures. The land treatment phase includes those conservation practices normally installed by, and within the financial capability of, the landowners and operators. It also includes critical area treatment for which additional financial assistance is needed. Through this phase, about 860 acres of cropland, 14,750 acres of pasture, 13,910 acres of range, 16,110 acres of forest, and 85 acres of urban and miscellaneous lands will receive conservation treatment for adequate protection. The cost for land treatment is about \$4,569,970 of which \$2,970,770 is PL-566 costs and \$1,599,200 is other costs. PL-566 costs are \$393,170 for accelerating technical assistance and \$2,577,600 for cost-sharing for 2,045 acres of critical area treatment.

Structural measures include 19 floodwater retarding structures, one flood prevention-municipal water-recreation structure, recreation facilities, and 25 acres of wildlife habitat mitigation measures. Structural measure costs are about \$7,185,400 of which \$2,442,530 are local and \$4,742,870 are PL-566.

Critical area treatment will be installed by force account, by the average cost method, and by contract. SCS will administer the contracts. Other land treatment will be installed by landowners and operators. The district will provide needed construction permits and ingress rights for maintenance inspections for critical area treatment. The SCS and Oklahoma Forestry Division will provide the technical assistance for detailed planning and installation of the land treatment phase.

Structures will be installed by federal contract administered by the SCS as requested by the sponsors. Engineering services for the flood-water retarding structures will be provided by SCS. Engineering services for the multipurpose structure and for the recreation facilities will be secured through engineering contracts. The conservation districts will secure land and water rights for the floodwater retarding structures and the City of Chandler will secure land and water rights for the multipurpose structure.

Land rights will be secured by donation or by purchase. Each of the districts will use their right of eminent domain where necessary. The Lincoln County Conservation District will provide relocation assistance advisory services at their expense and make relocation payment in connection with project related relocations of persons, businesses, or farm operations for site 1-M. No other relocations were found necessary at the time of the plan preparation. The sponsors and the SCS will each provide the project administration services they require and bear the costs incurred estimated to be \$50,000 and \$803,000, respectively.

The conservation districts will operate and maintain the floodwater retarding structures within their respective areas. The City of Chandler will operate and maintain the multipurpose structure and the recreation facilities. Operation and maintenance of the structures includes the associated wildlife mitigation measures. Estimated annual operation, maintenance, and replacement costs are \$39,350 of which \$28,000 is for the recreation development.

Sponsors' costs for installation and for operation and maintenance will be from donations, from watershed revolving funds, from tax revenues of the conservancy district, and from water receipts of the City of Chandler. The City of Chandler expects to secure a FmHA loan to finance a part of its installation cost.

Land treatment will reduce erosion to rates consistent with land uses, reduce runoff and sediment movement, reduce downstream flood damages a small amount, increase productivity, and improve the environmental quality of the area. Structural measures will reduce the frequency of flooding and attendant downstream flood, sediment and scour damages to a 3-5 year level of protection. The multipurpose structure provides capacity to meet Chandler's water supply needs, and recreational facilities to provide for 62,000 recreation days use. Streamflow below structures will be prolonged and the total volume of flow from the watershed will be decreased slightly by water supply diversion, and by evaporation. A total of 123 acres of woodland habitat will be destroyed and 162 acres will be flooded infrequently. Twenty new water habitats, about 1,698 acres, will be created. Installation will raise the noise, dust, and traffic levels in nearby areas temporarily.

Average annual monetary benefits from structural measures are about \$860,810, and average annual costs are about \$480,605, giving a benefit cost ratio of 1.8:1.0. About 75 owners or operators of flood plain land will receive benefits from structural measures. About 75,000 persons will be benefited by installation of this project.

PLANNED PROJECT

This plan includes land treatment and structural measures. Land treatment practices include those normally installed by the landowners and operators using available technical and financial assistance, and critical area treatment which requires additional financial assistance. Technical assistance is for gathering of resource information, conservation plan revision or preparation, and for measure installation. Structural measures include 19 floodwater retarding structures, one multipurpose (floodwater retarding-municipal water supply-recreation) structure with appurtenances, and fish and wildlife mitigation measures. Recreation facilities are planned at the multipurpose structure.

LAND TREATMENT

Adequate protection of land is achieved through proper management which includes installation of a combination or system of conservation practices designed for the climate, soil, and land use. Alternative combinations or systems of conservation practices described in SCS technical guides are designed to fit the physical limitations of the soil for several land uses and management levels. Typical conservation practices include conservation cropping systems, crop residue use, contour farming, diversions, terraces, grassed waterways, pasture and hayland planting, range seeding, proper grazing use, brush management, pasture and hayland management, wetland development, land protection during development, tree plantings, and critical area treatment. Critical areas include gullied and badly eroded areas located on farms and ranches, and along county roads. Treatment includes shaping and filling of gullies, installation of simple grade stabilization structures (usually pipes with appurtenances), concrete chutes and channel liners, diversion terraces, shaped waterways, vegetation (sod, planting of grass, shrubs, and trees), fertilization, and protective fencing.

Technical assistance is provided for soil surveys and other resource inventories needed to identify specific land treatment needs; for development of new conservation plans on individual units of watershed land; and for revision and updating of old conservation plans. The inventories will be completed, and the conservation plans will be developed through the leadership of the conservation districts with assistance provided by the SCS, the Oklahoma Forestry Division, and others. Each conservation plan will include the conservation practices agreed to by the landowner, the district, and the SCS.

Through the technical assistance provided, the watershed land will be examined for treatment needs, for adequate protection, and for efficient use. In developing conservation plans, the district, the SCS, the Oklahoma Forestry Division, and the affected landowners will discuss the treatment area, costs, effectiveness, and cost-sharing assistance.

Through this process each landowner or operator will be encouraged to install land treatment for adequate protection of his land. Fish and wildlife measures will be a part of the conservation practices considered and their installation, operation, and maintenance will be encouraged.

An installation schedule will be developed by the landowner, the district, the SCS, and the Oklahoma Forestry Division. The SCS and the Oklahoma Forestry Division will provide technical assistance for installation. The landowner or operator will use cost-sharing assistance available through the ASCS program. PL-566 funds will be used to cost-share in critical area treatment. Cost sharing with PL-566 funds will be limited to rates authorized under other programs.

An estimated 860 acres of cropland, 14,750 acres of pasture, 13,910 acres of range, 16,110 acres of forest, and 85 acres of urban and miscellaneous lands will be treated for adequate protection during the project installation period. The acreages above include about 1,955 acres of critical areas interspersed within farm and ranch land and about 90 acres along 235 miles of roadside.

STRUCTURAL MEASURES

The 19 floodwater retarding structures and one multipurpose structure are reservoir type impoundments and are designed to remain totally effective for 100-years. Common components consist of an earth-fill dam, a reinforced concrete principal spillway, and a vegetated emergency spillway.

Reservoir Type Structures

The earth fills will range in height from 22 to 64 feet and in volume from 39,500 to 855,000 cubic yards. The earth fills will be trapazoidal in cross section with a berm or riprap on the front slope for protection from wave action. Both front and back slopes of the dams will normally be 2.5:1.0 and the top widths will range from 14 to 20 feet.

The geologic formations underlying the watershed are composed of sandstone and shale members on which have developed soils of low to medium plasticity. Soil textures include sandy and silty clays, low plastic silts, and clayey and silty sands. These materials, in different combinations, will make up the fill materials of the dams. Structure foundations will involve soils ranging from shallow on the abutments to deep in the flood plain, all resting on typically "V" shaped rock profile.

Some sites, particularly numbers 11, 15, and 16, may have a high water table that could require a borrow area outside the sediment pool. Sites 1-M, 3, 9, and 18 may require some rock excavation in the emergency spillway. Foundation or abutment drains may be needed in sites 1-M, 3, 10, 11, 12, 18, and 20. Additional sites may be included in this group depending upon findings during the detailed geologic and foundation investigations.

The minimum area on which land rights will be acquired for the single-purpose sites will be 2,251 acres. The land area acquired for the multipurpose structure will be 2,250 acres. Of this amount, 1,070 acres will be in water surface and the remaining 1,180 acres will be open to the public for recreational purposes. Dams and spillways will cover 103 acres, sediment and permanent pools will cover 1,698 acres, and the detention pools will temporarily inundate 1,985 acres at their maximum levels. About 123 acres of timber will be in the sediment pools and the dam and spillway areas. Of this amount, about 40 acres will be in the multipurpose structure.

The principal spillways are made up of a drop inlet riser on the impoundment side of the dam, an outlet conduit under the dam, and an energy dissipator at the outlet of the conduit. The energy dissipator may be a plunge pool or an impact basin. The riser will be equipped with a trash guard and a valve for complete drainage of the reservoir. The multipurpose structure will be equipped with a municipal water supply tower, outlet conduit, and control valve for diversion of the municipal water supply. These appurtenances will be separate and apart from the principal spillway.

Principal spillway conduits are to be reinforced concrete pipe. The minimum diameter to be used will be 18 inches. The emergency spillways will be formed by a trapazoidal earth or rock cut around one end of the dam. They will be established to vegetation to prevent erosion with the exception of site 1-M where the spillway will be cut in rock.

The design life of each of the 20 structures is 100 years. Each is designed with capacity for sediment (9,003 acre feet total) and for floodwater detention (24,052 acre feet total). Sediment capacity is based on the expected accumulation in 100 years from the drainage area above the individual structures (total area controlled is 104.58 square miles). Floodwater detention capacity is based upon routings of runoffs from selected rainfall events through each structure. The multipurpose site will provide 5,310 acre feet of capacity for recreation water and 8,390 acre feet capacity for municipal water supply in addition to the capacity provided for sediment storage and floodwater detention. 1/

1/ Oklahoma Water Resources Board Resolution adopted 1/10/61 governs principal spillway riser elevations, minimum discharge pipe capacity, and water rights in floodwater retarding structures.

The crest of the principal spillway will normally be set at the estimated elevation of sediment accumulation at the end of 50 years. The discharge rate of the principal spillway and the floodwater detention capacity in each structure is designed to temporarily detain and to automatically release runoff from the principal spillway design storm rainfall within a 10-day period while maintaining the water level at or below the crest of the emergency spillway. The discharge rate of the principal spillway and the detention storage volume of each structure is designed to limit use of the emergency spillway to a selected frequency. There is a 1 percent chance that the emergency spillway of the multipurpose site will operate in any given year. The chance that the emergency spillways of the 19 other structures will function in any given year ranges from 2.8 percent to 4.0 percent.

Water may be stored in the space provided for the 50-year sediment accumulation in the 19 floodwater retarding structures until displaced by the sediment accumulation, or the landowner may elect not to store water in the site. Where initial storage of water will result in an unsatisfactory impoundment from an environmental standpoint, the crest of the principal spillway may be raised to the level required for a satisfactory impoundment. However, this elevation is limited to the elevation of the expected 100-year sediment accumulation. Where water is to be stored above the expected 50-year sediment level, a water right must be obtained by the landowner or operator. 1/

The vegetated earth or rock spillway at each site is designed to safely pass the discharge from the emergency spillway design storm rainfall and will carry the discharge from the freeboard storm with the water level below the top of the dam.

Modification of roads, bridges, and utilities involved in the watershed include: pipelines in structure 1-M, road and bridge in structure 15. Wildlife plantings will be incorporated in the erosion control plans of nine selected structures to reduce adverse effects on wildlife habitat resulting from construction of the project. Selected plantings of legumes, shrubs, and trees will be made in one to two acre plots totaling about 25 acres to provide food, cover, and habitat for mitigation of wildlife habitat losses. These plots will be fenced for protection where needed.

The SCS will provide technical assistance for development of erosion control plans including the plantings to mitigate wildlife habitat losses. The U. S. Fish and Wildlife Service will be invited to participate in the design of the habitat plantings.

A total of 31 persons will be displaced due to the project. All of these will be in the vicinity of the multipurpose site. It is estimated that a total of eight families will be displaced from houses and five farm operations will be displaced. No known minority or low income persons are included in the displaced persons.

1/ Refer to Oklahoma Water Resources Board Resolution of January 10, 1961.

Public access to the single-purpose site areas is not provided for in this plan. Owners of the land on which the sites are located may allow public access on an individual basis, however, neither the SCS nor the local sponsors will require it. Where public access is allowed, the landowner or operator will be responsible for providing adequate sanitary facilities as required by law.

Each construction contract will require the contractor to adhere to applicable provisions of the Clean Air and Federal Water Pollution Control Acts to minimize noise, air, and water pollution.

Occupational noise exposure will be kept to safe levels by the use of suppressant devices or through use of personal protection equipment. Standard sound level meters will be used to monitor construction activities, assuring that neither workers or inspectors will be exposed to harmful noise levels beyond that specified by the Labor Department Standards. Air, erosion, and water pollution will be held to a practical minimum by such practices as: 1) reducing the area and duration of exposure of earth fill and earth fill source areas; 2) stocking and replacing top soil on disturbed areas; 3) mulching areas likely to produce significant erosion; 4) sprinkling of earth fill source areas and other disturbed areas to minimize the production of dust; 5) scheduling and completing work by segment, where possible; 6) establishing erosion control vegetation or other pollution abatement measures as soon after work is completed as practical; 7) providing acceptable means of disposal of fuels and lubricants resulting from the operation; 8) providing sanitary facilities for disposal of sewage resulting from construction activities; 9) disposing of solid waste such as material cleared from the site, and that generated through construction activity in accordance with state regulations.

The use of pesticides and herbicides are not anticipated in the installation and operation and maintenance of this project. However, should this use become necessary, all applications will be consistent with the Federal Insecticides, Fungicides, and Rodenticides Act, as amended.

Surveys by professional archeologists and by historians have been reviewed by the state historical preservation officer and the state archeologist. As a result of these surveys one significant historical site, the William Tilghman homestead, was identified and subsequently included in the National Register of Historic Places. No archeological or historical values eligible for inclusion in the National Register of Historic Places will be impacted by the project measures. The SCS will keep alert for archeological or historical values that might be uncovered during detailed investigations or construction. Should such values be discovered, they will be immediately reported to the state historic preservation officer and the National Park Service's Office of Archeology and Historic Preservation in Denver, Colorado, and the procedures required by PL-93-291 will be followed.

Since this is a federally assisted local project, there will be no change in the existing responsibilities of any federal agency under

Executive Order 11593 with respect to archeological and historical resources.

On the multipurpose site involving recreation and municipal water, the sponsor of the development will comply with Oklahoma State Health Department regulations governing sanitary facilities and water quality control. These standards are set out in the 1973 edition of Oklahoma's Water Quality Standards.

Public Recreation Facilities

Recreation activities planned for this facility include boating, fishing, camping, and picnicking.

About 2.0 miles of trails will be developed around the lake for use in hiking or bicycling. About 4,000 square yards of asphalt parking lots and 5,000 square yards of gravel parking lots will be installed at three locations around the lake.

Three picnic areas are tentatively planned which will contain a total of two group shelters with concrete floors (20'x40'), 30 concrete tables (3'x6'), and 10 cooking grills. An unimproved camping area will be designated. Three wells with electric pumps will be installed to provide a sanitary source of drinking water and to provide water for three comfort stations with flush toilets which will be constructed in the vicinity of the picnic areas. Each of the comfort stations will be equipped with a septic tank and subsurface tile to serve as the waste disposal system. The system will be installed and serviced in accordance with Oklahoma Department of Health Bulletin #600. Three boat launching ramps, one passenger dock, and one fishing dock will be located so that the comfort stations will be nearby. All of the facilities will be constructed to facilitate their use by the handicapped.

About 10 acres of vegetative plantings will be installed around the facility for screening and improved esthetic values. These plantings will also provide some incidental wildlife benefits.

Sponsors will acquire fee simple title for all privately owned land to be used for recreation purposes in a project development where PL-566 cost sharing assistance is provided.

Rights-of-way required for public utilities, such as powerlines and pipelines needed to serve the recreational area, will be acquired by purchase or perpetual easement.

Construction of private facilities within the minimum land rights boundary is prohibited except for essential service facilities which are constructed or operated by private concessionaires on a controlled permit basis to serve the planned use of the improvement or development.

INSTALLATION COSTS - MONETARY

Costs reflected in this plan are estimated based on computed amounts and 1976 prices plus a contingency allowance to account for unforeseen items. A contingency allowance of 15 percent is used unless otherwise specified.

The project cost of \$11,755,370 includes \$4,569,970 for the land treatment phase and \$7,185,400 for the structural phase. About 65 percent (\$7,713,640) of the project cost will be from PL-566 funds and 35 percent (\$4,041,730) will be from other funds.

Land treatment costs, estimated to be \$4,569,970, includes \$803,600 to continue the going programs rate of installation of conservation practices and \$149,700, to accelerate the going program rate of installation plus \$3,616,670 for critical area treatment. The SCS will provide about \$118,100 and the Oklahoma Forestry Division will provide about \$2,400 for funding the technical assistance to continue the going program under their going program with the U. S. Forest Service. The SCS will provide about \$393,170 from PL-566 funds for technical assistance to accelerate the rate of conservation practice installation and to install the critical area treatment. The Oklahoma Forestry Division will provide about \$900 from their regular program funds for technical assistance for installation of critical area treatment.

Installation costs for the critical area treatment will be from funds of the affected landowners and operators and from PL-566 funds. Funding for the on going land treatment program will be from funds of the landowner or operator with cost sharing assistance provided by the ASCS or other cost sharing programs.

Installation costs for structural measures are estimated to be about \$7,185,400 and include construction, land rights, engineering services, relocation payments, and project administration. The amount of costs in these categories are itemized in Tables 1 and 2 of this plan. About 66 percent (\$4,742,870) of the installation cost for structural measures will be from PL-566 funds and about 34 percent (\$2,442,530) will be from other funds. Specific cost sharing percentages for the above cost categories for the structural measures are reflected in the plan agreement. Construction costs are made up of the following costs: 1) timber clearing in site areas; 2) construction of pumping plants to carry interior or surface water; 3) construction of diversion dikes and ditches for surface water control; 4) flagmen and protective devices to protect the public or the workmen; 5) alteration, modification, or reconstruction of existing irrigation or drainage facilities made necessary by the project; 6) borrow material when actually purchased by the sponsors; 7) construction of handrails, fences, gates, etc., needed for the proper functioning and operator's safety of a structural measure. This also includes any safety features needed for public recreation or

fish and wildlife in a project; 8) premiums for construction liability insurance; 9) provisions for fire prevention and suppression made necessary by construction activities; 10) establishment of vegetation on all construction sites and areas disturbed during construction to prevent erosion, improve stability, and to restore or maintain wildlife habitat and the esthetic quality of the environment. This includes herbaceous and woody plantings for erosion control, wildlife food, shelter, and walkways. These plantings can also be used for screening or improving the appearance of structural measures.

The construction cost for the single-purpose structures is about \$1,961,600. Included in this amount are the costs for rock excavation in the emergency spillways in sites 3, 8, 14, and 18, and for vegetation of spillways, dams, and other disturbed areas. About 17 acres of wildlife habitat plantings will be made to partially mitigate habitat losses at sites 2, 4, 5, 6, 8, 14, 18, and 20, in addition to other items as outlined above.

Construction costs for the multipurpose structure is estimated to be about \$1,923,300. This includes \$115,000 for a water supply inlet tower, outlet conduit, and release facility; the cost of rock excavation in the emergency spillway; recreation facilities; a concrete control section in the emergency spillway; vegetation of disturbed areas; and about 8 acres of wildlife habitat plantings to mitigate the losses of habitat caused by construction.

Engineering costs (about \$384,400) includes the costs for detailed geologic investigations, soil testing, detailed surveys, preparation of designs, plans and specifications, etc., for the structural measures. This cost reflects the value of engineering services to be provided by the SCS and the estimated price for engineering services to be secured through contract with consultants for the multipurpose structure and the recreation facilities.

Land rights costs include the estimated value or costs for lands to be acquired in fee title; easements; removal, relocation, or modification of existing telephone, power, gas, water, and sewer lines or other utilities; removal of buildings or improvements for salvage or relocation, or the construction of dikes or other protective works; all new or changes of existing public or private roads; all relocations and changes of roads and railroads that are to remain serviceable after project installation; relocation or reconstruction of fences not required for proper operation of the project; installation of new fences or guardrails for protection or safety of the public; salvaging fences or timber; and some liability insurance costs.

Land rights costs for the 19 single-purpose structures are estimated to be about \$437,100. This includes cost of land and easements, about \$435,100, and the cost of road and bridge modification, about \$2,000. Land rights costs for the multipurpose structure and recreation facilities are estimated to be about \$1,464,000. This includes about \$1,350,000 for fee title to about 2,250 acres; about \$5,000 for engineering surveys and legal fees; about \$105,000 for alteration or modification of improvements; and about \$4,000 for flowage easements.

Relocation payment costs, about \$162,000, are estimates of payments to be made in connection with persons, businesses, or farm operations displaced as a direct result of land rights acquisition. Payments are made to cover the costs of moving and related expenses for a displaced person, business, or farm operation as well as financial assistance for replacement housing for a displaced person, in some instances. Relocation payments are expected to occur only in connection with the multipurpose site. The other 19 structures are not expected to involve any displacements.

Costs for project administration services are estimated to be about \$853,000. These services include relocation assistance advisory services, administrative functions connected with relocation payments, securing permits for project installation, contract administration, review of engineering plans prepared by others, government representatives, and inspection services during installation. Relocation assistance advisory services costs are estimated to be about \$3,500 and must be provided by the sponsors without PL-566 cost sharing.

The costs for the 19 single-purpose structures were allocated entirely to flood prevention. The costs of the multipurpose site were allocated to three purposes: flood prevention, recreation, and municipal water supply. Joint construction, engineering, and relocation payment costs are allocated based on the capacity provided in the reservoir for each purpose (flood prevention 11,300 acre-feet or 45.20 percent, municipal water supply 8,390 acre-feet or 33.56 percent and recreation 5,310 acre-feet or 21.24 percent). The construction and engineering costs for the municipal water supply inlet structure are allocated to the municipal water supply purpose. The costs for the land rights for the 2,250 acres to be acquired in fee title were allocated between municipal water and recreation based on the surface area required for each purpose (municipal water - 410 acres or 18.22 percent, and recreation -1,840 acres or 81.78 percent). This included the fee title price, engineering survey and legal costs, and the costs for relocation, modification, or removal of facilities. The costs for flowage easements were allocated to flood prevention. The costs for land rights associated with the recreation facilities are incorporated into the allocation for the multipurpose

site. Construction and engineering costs for recreation facilities are allocated to the recreation purpose.

Allocation of costs for the multipurpose structure and recreation facilities are shown in the following table:

MULTIPURPOSE STRUCTURE - COST ALLOCATION

Cost Category	Total Cost (dollars)	Allocated Costs		
		Flood Prevention (dollars)	Recreation (dollars)	Municipal Water Supply (dollars)
Construction				
Joint	1,461,000	660,370	310,320	490,310
Inlet Structure	115,000	-	-	115,000
Recreation Facilities	347,300	-	347,300	-
Engineering				
Joint	103,000	46,560	21,880	34,560
Inlet Structure	12,000	-	-	12,000
Recreation Facilities	29,700	-	29,700	-
Relocation Payments ^{1/}	162,000	73,220	34,410	54,370
Land Rights				
Fee Title 2,250 ac.	1,350,000	-	1,104,000	246,000
Eng. Survey and Legal Fees	5,000	-	2,500	2,500
Alt. or Mod. of Improvements	105,000	-	55,000	50,000
Flowage Easements	4,000	4,000	-	-
	3,694,000	784,150	1,905,110	1,004,740

^{1/} Relocation costs are shared between PL-566 and other funds on the basis of PL-566 and other project costs less the relocation payments as shown in Table 1, page P-35.

ECONOMIC BENEFITS

The total average annual benefits resulting from the installation of structural measures are estimated to be \$860,810 (Table 6). Of this total, about \$213,420 are flood damage reduction benefits. Included in the flood damage reduction benefits are \$149,550 for less flooding, \$34,570 for reduced sediment deposition, \$14,440 for less floodplain scouring, and \$14,860 for a reduction in indirect damages. More intensive land use will provide \$72,760 in benefits and changed land use will provide \$56,490.

Since the watershed is located in an area designated by the Secretary of Agriculture as eligible for rural area development under the Economic Development Act of 1965, employment benefits are used for project development. The employment benefits accrue through the employment of unemployed and under-employed during the installation of the project and from operations and maintenance of project measures during a 20-year period. The average annual amount of these benefits is estimated to be \$40,640.

The average annual municipal water supply benefits accruing as a result of municipal water storage in multipurpose site 1-M are estimated to be \$338,000. Municipal water supply benefits were determined by the consulting engineer for the City of Chandler.

The average annual recreation benefits from public use of the recreational facilities and water storage in the multipurpose site will amount to \$139,500.

Total average annual benefits of the project are estimated to be \$860,810, while total average annual costs are estimated to be \$480,605. The ratio of average annual benefits to average annual costs is 1.8:1.0.

INSTALLATION AND FINANCING

LAND TREATMENT

Land treatment will be installed through cooperation of landowners and operators with their conservation district. Land treatment falls into two categories from the standpoint of installation.

The first category includes those conservation practices normally installed by owners and operators with technical and financial assistance available through going conservation programs. Measures in this category, together with accelerations needed to meet the goals of this plan, will be installed by the owners and operators. The soil conservation districts will provide leadership. The SCS and the Oklahoma Forestry Division will provide technical assistance. The owners and operators will utilize cost-sharing assistance available for eligible measures.

The second category includes critical area treatment for active gullies and badly eroded areas. Treatment costs are outside the financial capabilities of landowners and operators with technical and financial assistance available. These measures will be installed with technical and financial assistance from PL-566 funds as outlined below.

Critical area treatment will be a part of agreed-to conservation practices included in new or revised conservation plans for each affected operating unit. These conservation plans will include: a plan for conservation land treatment; an installation schedule; requirements for operation, maintenance, and replacement; provision for access by SCS and the district, or its agent, to inspect installation and operation and maintenance; and signatures of the district and the owner or operator. These plans will serve as the operation and maintenance agreement. The conservation district will provide the leadership and coordination. The SCS will provide technical assistance through the conservation districts for preparation of the conservation plan, installation plans, standards and specifications, and for layout and inspection of construction. The Oklahoma Forestry Division through their going program will furnish technical assistance for the forest related practices.

Immediately before installation, the sponsor (the affected county commissioner or conservation district), and the SCS, will enter into a project agreement for all, or part of the critical area treatment included in a conservation plan or several conservation plans. The project agreement will cover work that can be started in 90 days and completed within 18 months. Each project agreement will describe the critical area treatment to be installed (except for the average cost method), the method of installation, the cost-sharing rates or arrangements, technical assistance for installation, inspection, duration of agreement, and related subjects.

Installation of critical area treatment will be by force account, by the average cost method, and by contract.

Force Account - This method applies only to critical area treatment for county roads.

The responsible county commission will secure needed landrights and construction permits and install the critical area treatment in accordance with the terms of a project agreement executed immediately before the work commences. The county labor force and equipment will be used to install the critical area treatment. Minor amounts of equipment may be secured through rental. The county commission will maintain cost records of work performed in terms of equipment, materials, and labor. Requests for reimbursement must be supported by the cost records. The SCS will reimburse the county commission for work performed through each project agreement on the basis of 80 percent of the actual cost of the work. The county commission will comply with all applicable local, state, and federal regulations in installing the critical area treatment.

The project agreement will contain work that can be started within 90 days and completed within 18 months; and be supported by necessary designs and drawings, and cost estimates prepared immediately before signing the document. It will include itemized units of work and estimated costs of labor, equipment, and material required to install each unit, and the estimated total cost of the work.

The project agreements containing work in excess of \$30,000 in cost will be submitted to the Washington office of the SCS for approval. The request for approval must be supported by a comparative cost analysis for installation by federal contract and by force account. A savings of 10 percent must be realized before force account may be used.

Average Cost Method - This method applies to critical area treatment for individual farms and ranches.

In addition to the general content described above, each project agreement will include the names of the cooperators on whose land work is to be accomplished, the cost-share rate, and the total of such work covered by the project agreement. In addition, the agreement will provide for the sponsor to enter into individual agreements with each cooperator to provide for actual installation of the work.

The sponsor-cooperator agreement will provide for installing the critical area treatment on each cooperator's operating unit in accordance with a conservation plan of operations and installation schedule within an 18 month period. The cooperator involved may install the treatment using his own labor and equipment or employ the services of vendors and contractors to install the measure. Landrights are provided by the cooperator through the district agreement.

The SCS will share in the cost of installed critical area treatment based on a percentage of the average cost when the cooperator installs the work using his own forces, or on a percentage of the actual cost

not to exceed the average cost for any component of the work installed by a vendor or contractor. Average costs are determined from actual costs for similar work recently installed in the general area.

Upon completion of a practice or component of a practice by a vendor or contractor, the cooperator will provide the district with records to show actual cost of the work. The district will take steps necessary to ensure that cost records of work that the cooperator has performed by vendors and contractors are suitable to base a claim to SCS for the PL-566 share of the costs.

Contract - The critical area treatment planned for a single farm or ranch, or a group of farms or ranches, may be installed by federal contract at the option of the SCS, the responsible conservation district, and the affected landowners or operators. The districts will provide such landrights that may be required. The SCS will administer the contracts as requested by the conservation districts. The affected soil conservation district will work with SCS in installation of the work and in administering any contracts.

Standard project agreements between the SCS and the affected conservation districts will be used when federal contracts are used to install all of the treatments on one or more operating units. Sponsors will deposit with the SCS the estimated local share of the estimated cost prior to awarding the contract.

STRUCTURAL MEASURES

The conservation districts, each in their respective areas, will acquire needed permits and landrights for the 19 floodwater retarding structures. The City of Chandler will acquire the permits and landrights for multipurpose structure 1-M, and the recreation facilities. The permits and land rights will be sufficient for structure occupancy, operation and maintenance, borrow areas, construction roads, and other temporary activities needed for installation. Land rights include relocation, removal or modification of affected roads, utilities, pipelines, etc., and associated engineering services.

The sponsors will acquire the permits and land rights through donation, purchase from willing sellers, or through the use of their power of eminent domain. The conservation districts and the City of Chandler each have the power of eminent domain.

The sponsors will provide for all surveys and legal work needed for acquisition of permits and land rights without PL-566 cost sharing. The sponsors must have the land rights to be acquired appraised and checked by qualified appraisers prior to initiation of negotiations. This will

establish prices for these interests where they are to be acquired through means other than donation. Landowners will be given an opportunity to accompany the appraisers in reviewing the land rights to be acquired.

About 2,250 acres of land will be acquired in fee title for multipurpose structure 1-M and the recreation facilities. Easements will be sufficient for other structures. Any land rights acquired in fee title in excess of the requirements for installation, operation, and maintenance of the structural measures may be resold at the option of the sponsors.

The City of Chandler will acquire the needed water rights for municipal water supply and recreation capacity in multipurpose site 1-M. Individual landowners involved in the single purpose floodwater retarding structures must acquire water rights needed for storage of water in excess of the 50-year sediment volume. Where such storage is needed for environmental purposes, the affected conservation district will assist the landowner in acquiring the rights.

The SCS will provide engineering services required for detailed investigations including geologic investigation and engineering surveys, and for preparation of plans and specifications for the 19 floodwater retarding structures. Similar engineering services for multipurpose structure 1-M and the recreation facilities will be secured through engineering contracts negotiated by the City of Chandler.

The SCS will assist the sponsors in the administrative functions related to relocations of persons, business or farm operations; review of engineering plans prepared by others for multipurpose site 1-M and the recreation facilities; administering construction contracts for structural measures; furnishing government representative and construction inspection; and providing related clerical and administrative services. In connection with construction inspection at multipurpose site 1-M, the SCS will inspect those features related to the joint features, and the specific features related to the flood prevention and recreation purpose, and where malfunction or failure could adversely affect these features, it will inspect the specific municipal water supply features.

The conservation districts will provide relocation assistance advisory services in connection with relocations of persons, business and farm operations, as described below, and general administration, clerical and construction inspection services the district requires to insure that the structures are installed as planned. The City of Chandler will provide construction inspection relating to the municipal water supply features of multipurpose site 1-M.

The SCS will provide technical assistance for development of erosion control plans including the plantings to mitigate wildlife habitat losses. The Fish and Wildlife Service will be invited to participate in the design of the habitat plantings.

The conservation districts, each in their respective areas, will work with the SCS in administering construction contracts for the 19 flood-water retarding structures. The City of Chandler will work with the SCS in administering contracts for multipurpose structure 1-M and the recreation facilities.

The Oklahoma County and the Lincoln County Conservation Districts, each in their respective areas, will comply with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-674, 84 Stat. 1894) effective January 2, 1971, and the regulations of the Secretary of Agriculture pursuant thereto in acquiring land rights.

The City of Chandler will provide relocation assistance advisory services and other related services, and make relocation payments in connection with displacements involved in the acquisition of land rights for multipurpose structure 1-M. The city will: (1) provide personally or by first class mail, written notice of displacement, and appropriate application forms to each displaced person, business or farm operation; (2) assist in filing applications; (3) review and process grievances in connection with displacements; and (4) make relocation payments. The SCS as a part of the project administration may assist the district in these actions. The city will without PL-566 cost-sharing, provide relocation assistance advisory services as outlined below:

1. Assist in determining the needs for relocation assistance.
2. Make available current and continuing information on the availability, prices, and rental rates of comparable decent, safe and sanitary sales and rental housing, and comparable commercial properties, and farms.
3. Assure that within a reasonable period of time, prior to anyone having to move from acquired dwellings, there will be available a decent, safe, and sanitary replacement dwelling.
4. Provide assistance to anyone displaced from his business or farm operation by the project, and help him in obtaining, and becoming established in a suitable replacement location.
5. Supply, to displaced persons, information concerning federal and state housing programs, disaster loan programs, and other federal or state programs which offer various types of assistance or service to such persons.

6. Provide such personal counseling and other advisory services as may be desired, in order to help individuals relocate with the least amount of hardship and problems.
7. Assist individually in preparing their application for relocation payments for which they may be eligible.

The city has determined that decent, safe, and sanitary replacement housing will be available for all persons displaced by the project. Displaced persons will be given at least 90 days notice before they are required to move.

Although planning studies show that relocations of persons, business or farm operations are only necessary for multipurpose site 1-M, each sponsor will carry out their responsibilities with the conditions that exist when land rights are acquired.

Land treatment and structural measures will be installed over an 8-year period. The installation schedules will be adjusted on a year-to-year basis to reflect changes mutually agreeable to sponsors and the SCS. An estimated schedule for obligation of funds follows:

Land Treatment Year	Public Law 566 Funds		Other Funds		Fiscal Total
	Land Treatment	Structural	Land Treatment	Structural	
	Measures (Dollars)	Measures (Dollars)	Measures (Dollars)	Measures (Dollars)	
1	377,300	300,000	225,900	405,380	1,308,580
2	377,300	300,000	225,900	405,300	1,308,500
3	377,300	429,500	220,900	830,300	1,858,000
4	377,300	729,500	220,000	801,500	2,128,350
5	377,300	740,300	177,300	-	1,294,900
6	361,500	740,300	176,400	-	1,278,200
7	361,500	740,300	176,400	-	1,278,200
8	361,270	762,970	176,400	-	1,300,640
Total	2,970,770	4,742,870	1,599,200	2,442,530	11,755,370

PL-566 technical and financial assistance for land treatment measures will be provided immediately upon authorization based upon the above conditions.

PL-566 assistance for structural measures is subject to the following conditions:

1. 50 percent of the land above structural measures is under conservation agreement to apply, operate, and maintain needed conservation treatment.

2. 75 percent of the critically eroding sediment source areas that would significantly affect the design and operation of structural measures has been treated or is being treated concurrently with the installation of structural measures.
3. Sponsors have demonstrated their willingness and ability to acquire and pay for the necessary land rights using their power of eminent domain when necessary.
4. Have obtained, or have options to obtain, land rights for 2 years construction work within a construction unit.
5. Have executed necessary project land rights and operation and maintenance agreements.

Construction units were considered and the units listed below were determined to be separate construction units. Each of these units is an independent part of the proposed project and can consequently be justified on its own merits (see Table 7). They can also be constructed in any order since each is also an independent hydrologic unit.

- | | |
|----------------------|------------------------|
| 1. Site 1-M | 5. Sites 9 through 12 |
| 2. Sites 2 and 3 | 6. Sites 13 and 14 |
| 3. Sites 4 through 6 | 7. Sites 15 and 16 |
| 4. Sites 7 and 8 | 8. Sites 17 through 20 |

Sponsors have analyzed their financial needs for installation and operation, maintenance, and replacement, and have provided assurances to the SCS that funds will be available at the time, and in the amounts required.

It is expected that land rights for the floodwater retarding structures will be acquired largely through donations. This is supported by attitudes of affected landowners, and through experience in other watershed projects in Oklahoma. Land rights that must be purchased will be financed through state watershed revolving funds, and by tax revenues of the Kickapoo Nations Conservancy District. State revolving funds become available only after 90 percent of the needed land rights within a watershed have been acquired by other means. Operation, maintenance, and replacement costs after installation will be from resources of affected landowners and tax revenues of the conservancy districts.

The City of Chandler expects to secure a FmHA loan to finance a part of its cost for land rights, recreation and water supply capacity, recreation facilities, and relocation payments. The possibility of this loan has been discussed with the SCS and the FmHA.

The SCS will provide financial assistance for works of improvement as described in this plan under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666), as amended. Installation of land treatment measures will be funded not only through the PL-566 program, but also through other programs. The ASCS will provide financial assistance for installation of many of the land treatment measures applied while the technical assistance will be provided through SCS funds. The FmHA will provide a source of funds for the sponsors to use in carrying out their portion of the planned project which cannot be financed through other sources.

The Soil Conservation Service recognizes that archeological sites, undetectable from surface evidence, may be unearthed by construction activities. If such a discovery is made, the procedures required by Section 3 of PL 93-291 will be followed, and salvage or preservation needs will be determined.

Since this is a federally assisted local project, there will be no change in the existing responsibilities of any federal agency under Executive Order 11593 with respect to archeological and historical resources.

Prior to entering into agreements that obligate funds of SCS, the City of Chandler, will develop a code of conduct governing the performance of its officers, employees, or agents in contracting with or expending PL-566 funds; and a financial management system for control, accountability, and disclosure of PL-566 funds received; and for control and accountability for property and other assets purchased with PL-566 funds.

OPERATION, MAINTENANCE, AND REPLACEMENT

Measures in this plan will be operated and maintained by sponsors and landowners or operators with technical assistance from local, state, and federal agencies in accordance with their delegated authorities. A specific operation and maintenance plan will be prepared for each structural measure utilizing the watershed operations and maintenance handbook adopted for watersheds in Oklahoma. The land treatment measures will be operated and maintained in accordance with the conservation plan for each operating unit.

LAND TREATMENT

The Oklahoma County and the Lincoln County Conservation Districts and the Lincoln and Oklahoma County Commissions are each responsible for operation, maintenance, and replacement (OM&R) of the land treatment phases of this plan within their respective jurisdictions. The districts will each carry out their responsibilities for both private and public land through agreements with landowners and operators to install, operate, maintain, and replace short life elements of the treatment and adopt management measures outlined in conservation plans for each operating unit. The respective county commissions will operate and maintain the CAT work installed on county roads in accordance with the OM&R agreement developed for each specific project.

Establishment and OM&R of the critical area treatment is particularly important. Each conservation plan for farms, ranches or county road systems covering critical area treatment will include provisions for OM&R and provide for access by the district, the SCS, or other federal, state, or local agencies providing technical assistance through, or acting for, the district to inspect the measures. Each such conservation plan agreement will be signed by the affected conservation district and the owner or operator, and will serve as the OM&R agreement. A period of two years after initial installation is allowed for establishment including both minor structures and vegetation components. During this period, the SCS will cost-share in repairs on the same basis as for initial installation. The critical area treatment will be inspected annually, after rain, drought, fire, or other occurrences that might adversely affect the treatment. The district, the SCS, and the Oklahoma Forestry Division will perform the inspections for the first three years. The district will make the inspections for the next seven years after which inspections will be discontinued. The district will prepare reports setting forth the conditions of the treatment and any OM&R needs after each inspection, and furnish the SCS a copy of the report. The district will follow up with landowners and operators to accomplish the OM&R needs.

Operation may include those activities, such as mowing, fertilizing, removal of debris and obstructions which will enable the measures to function as planned. Maintenance includes timely repairs such as

filling of eroded areas, replanting to vegetation, repair of concrete, pipe, or similar elements. Replacement includes replacement of short life elements, of badly damaged sections of concrete, pipe, fences, or similar appurtenances as needed for continual operation.

Eatablishment and OM&R of other land treatment measures are also vital in achieving the objectives of this plan. The district and the SCS will make periodic reviews of the status of installation and periodic inspections of measures installed to determine any OM&R needs. Conservation plans will be updated as needed. The district will follow up with landowners and operators to accomplish the needed work.

Technical assistance for installation and OM&R of the land treatment phase of this plan will be provided by SCS, the Oklahoma Forestry Division, and other federal, state, and local agencies, through the Oklahoma County and Lincoln County Conservation Districts, in accordance with agreements between the agencies and the districts.

Landowners and operators and county commissioners will operate, maintain, and replace elements of the land treatment and bear the costs incurred. The district may lend, rent, or perform part of the work with district equipment and manpower. Cost-sharing assistance available through the ACP or other federal program may be utilized as available.

STRUCTURAL MEASURES

The Oklahoma County and the Lincoln County Conservation Districts, and the City of Chandler, will operate and maintain the structural measures including appurtenances and the associated wildlife mitigation measures. They will replace worn or inoperative elements when needed. The Oklahoma County Conservation District is responsible for operation, maintenance, and replacement in connection with sites 4 through 8. The Lincoln County Conservation District is responsible for OM&R in connection with sites 2, 3, and 9 through 20. The City of Chandler is responsible for OM&R in connection with multipurpose structure 1-M including the recreation development associated with that site.

Operation of the structural measures, appurtenances, and associated wildlife mitigation measures will include management to insure that they perform the functions for which they were planned. For the reservoirs and structures, this will consist of actions which will prevent the principal and emergency spillways from being altered or obstructed, and to insure that water quality in the multipurpose structure remains suitable for municipal water supply and recreation purposes.

It is particularly important that the spillway areas, the floodwater detention storage areas, and the recreation facilities area be kept free of unauthorized buildings, fences, roads, and the like, that might impair the operation of the structures or the recreation development. The City of Chandler understands that the lands acquired in fee title for multipurpose site 1-M, and the recreation development are to be kept from private development except for essential service facilities which may be constructed or operated by private concessionaires on a controlled permit basis to serve the planned use of the improvement or development.

Operations of the multipurpose structure site 1-M will involve the withdrawal of water for municipal water supply purposes, and the maintenance of the recreation pool above elevation 881.2 feet MSL. Operation studies which took into account water yield from the drainage area above site 1-M maximum water supply demands, and evaporation and seepage losses show that the water level of the reservoir can be maintained above elevation 881.2 feet MSL (see Figure 1). The City of Chandler will notify SCS through the state conservationist, if drawdown below the specified elevation is necessary. If it is determined that there is a continuing need for the use of recreation storage for municipal water supply purposes, the City of Chandler will reimburse the federal government for all of the PL-566 funds used for the recreation development associated with that reservoir. Operation of the recreation facilities and the recreation development includes custodial, sanitation, policing, safety, and similar services, and a frequent check of the facilities and their use to insure that the development is functioning as planned. Collection and disposal of solid waste in connection with operation and maintenance of the recreation facilities will be handled by the City of Chandler Sanitation Department in the same manner as for the City.

The City of Chandler will comply with Oklahoma State Health Department and Federal regulations governing sanitation, water quality, or chemical usage, in connection with the multipurpose reservoir and the recreation development. The Oklahoma State Health Department and the City of Chandler will jointly monitor sanitation and water quality. The County Health Department will monitor sanitation in connection with the recreation area.

The sponsors and landowners or operators will operate and maintain fish and wildlife mitigation measures included in the plan. Wildlife mitigation areas will normally be fenced so that grazing or other uses may be restricted. The Oklahoma Department of Wildlife Conservation, the U. S. Fish and Wildlife Service, and the SCS will provide technical assistance in the operation and maintenance of the fish and wildlife resources in the watershed.

Maintenance of the earth dams, principal and emergency spillways, and reservoir areas, includes such items as: replacement of soil removed

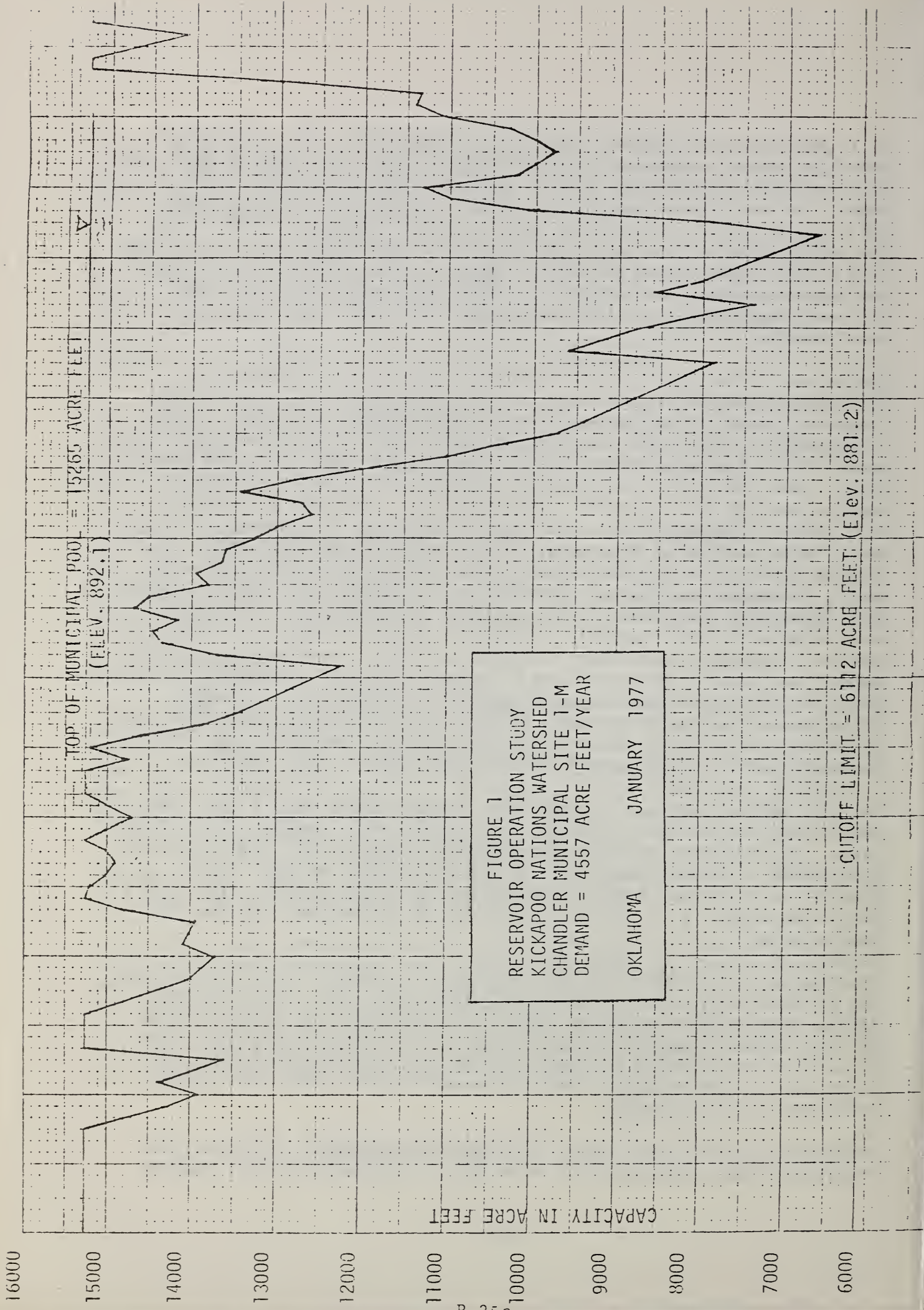


FIGURE 1
RESERVOIR OPERATION STUDY
KICKAPOO NATIONS WATERSHED
CHANDLER MUNICIPAL SITE 1-M
DEMAND = 4557 ACRES FEET/YEAR
OKLAHOMA JANUARY 1977

CAPACITY IN ACRE FEET

by rodents; clean out of relief wells and drains; repair of damaged riprap; stabilization of slide areas; maintenance of dikes and fills at proper elevation; replacement of eroded material in spillways and on dams and perimeter areas; immediate revegetation as needed and mowing; control of undesirable vegetation; fertilizing; controlled grazing; and removal of trash and debris likely to clog spillways or adversely affect operation. Maintenance of the recreation development includes many of the above items and, in addition, timely repairs of the facilities to correct problems resulting from vandalism, use, and natural occurrences.

Replacement in connection with all structural measures includes replacement of badly damaged elements and short life elements at the end of their useful life. Examples include replacement of fences, relief well casings and drains, trash racks, gates and valves, risers, picnic tables, and other recreation facilities.

Annual operation, maintenance, and replacement costs are estimated to be \$39,350, of which \$28,000 is for the recreation development including replacement of the facilities. It is expected that much of the routine OM&R in connection with the 19 floodwater retarding structures will be performed by the landowner or operator on whose land the structure is located. The respective conservation districts will secure any funding needed for OM&R of the single purpose structures, appurtenances, and fish and wildlife mitigation measures through donations from revenues for services they provide, and tax revenues raised by the Kickapoo Nations Conservancy District. The City of Chandler will secure funding for OM&R in connection with multipurpose structure 1-M and the recreation development from its regular source of revenue. The city does not plan to impose use charges. However, should they later find this action necessary, any use charges will be limited to that required to repay their investment and for operation and maintenance of the recreation development.

Specific operation and maintenance agreements between the SCS and the sponsor responsible for operation and maintenance of each structure will be executed prior to signing a land rights, relocation, or project agreement. The OM&R agreement will detail specific operation and maintenance responsibilities of sponsors and include specific provisions for retention, use, and disposal of property acquired or improved with PL-566 cost-sharing.

Upon completion of installation, including development of associated wildlife mitigation areas, the sponsors will accept the structures for operation and maintenance. A three-year period is allowed for establishment of vegetation. During this period, any required revegetation will be cost-shared with PL-566 funds on the same basis as for the

initial installation. PL-566 funds shall not be used to make repairs or correct problems resulting from poor operation or maintenance or for replacement of short life elements of the structures.

Operation, maintenance, and replacement for the measures included in this plan have been discussed between the sponsors and the SCS and the sponsors understand their obligations.

To guide or monitor operation and maintenance, inspections will be made annually, after unusually severe floods, and after occurrences of any other unusual condition that might adversely affect the structural measures. These inspections will be made by the sponsors and the SCS for the first three years, and by the sponsors thereafter. The sponsors will prepare reports of the inspections detailing the need for operation, maintenance, and replacement, and provide SCS with a copy.

The sponsors will take such action as needed to accomplish the needed work. The SCS and other local, state, and federal agencies will provide technical assistance in accordance with their delegated responsibilities and authorities.

AGREEMENT

Between the following local organizations:

Kickapoo Nations Conservancy District

Lincoln County Conservation District

Oklahoma County Conservation District

City of Chandler

Lincoln County Commission

Oklahoma County Commission

(Referred to herein as sponsors)

State of Oklahoma

and the

Soil Conservation Service

United States Department of Agriculture

(Referred to herein as SCS)

Whereas, application has heretofore been made to the Secretary of Agriculture by the sponsors for assistance in preparing a plan for works of improvement for the Kickapoo Nations Watersheds, State of Oklahoma, under the authority of the Watershed Protection and Flood Prevention Act (16 U.S.C. 1001-1008); and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the SCS; and

Whereas, there has been developed through the cooperative efforts of the sponsors and the SCS this plan for works of improvement for the Kickapoo Nations Watershed, State of Oklahoma;

Now, therefore, in view of the foregoing considerations, the Secretary of Agriculture, through the SCS and the sponsors, hereby agree on this plan and that the works of improvement for this project will be installed, operated, and maintained in accordance with the terms, conditions, and stipulations provided for in this watershed plan and including the following:

1. The sponsors will acquire such land rights as will be needed in connection with the works of improvement. The percentages of this cost to be borne by the sponsors and the SCS are as follows:

<u>Works of Improvement</u>	<u>Sponsors (percent)</u>	<u>SCS (percent)</u>	<u>Estimated Land Rights Costs</u>
19 Floodwater Retarding Structures	100.00	0	\$ 433,100
Alteration or Modification of Improvements*	100.00	0	2,000
Legal Fees	100.00	0	2,000
Multipurpose Site 1-M and Recreation Facilities--2,250 Ac.	59.11	40.89	1,350,000
Alteration or Modification of Improvements*	100.00	0	2,000
Legal Fees	100.00	0	5,000
Flowage Easements	100.00	0	4,000

*Including necessary engineering services, construction, and additional land costs.

The sponsors agree that all land acquired or improved with PL-566 financial or credit assistance will not be sold or otherwise disposed of for the evaluated life of the project except to a public agency which will continue to maintain and operate the development in accordance with the Operation and Maintenance Agreement.

2. The sponsors assure that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the sponsors and SCS as follows:

<u>Works of Improvement</u>	<u>Sponsors</u> (percent)	<u>SCS</u> (percent)	<u>Estimated Relocation Payment Costs</u> (dollars)
Relocation Payments	29.57	70.43	162,000

3. The sponsors will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.
4. The percentages of construction costs to be paid by the sponsors and by SCS are as follows:

<u>Works of Improvement</u>	<u>Sponsors</u> (percent)	<u>SCS</u> (percent)	<u>Estimated Construction Costs</u> (dollars)
19 Floodwater Retarding Structures	0	100.00	1,961,600
1 Multipurpose Structure	44.18	55.82	1,461,000
Recreation Facilities	50.00	50.00	347,300
Inlet Tower	100.00	0	115,000

5. The percentage of installation costs of the critical area treatment measures to be paid by the Sponsors and by the SCS are as follows:

<u>Works of Improvement</u>	<u>Sponsors</u> (percent)	<u>SCS</u> (percent)	<u>Estimated Installation Cost</u> (dollars)
Critical Area Treatment			
On farms and ranches	20.00	80.00	2,127,200
On county road systems	20.00	80.00	1,095,400

6. The percentages of the engineering costs to be borne by the sponsors and the SCS are as follows:

<u>Works of Improvement</u>	<u>Sponsors (percent)</u>	<u>SCS (percent)</u>	<u>Estimated Engineering Costs (dollars)</u>
19 Floodwater Retarding Structures	0	100.00	239,700
1 Multipurpose Structure	33.56	66.44	103,000
Recreation Facilities	50.00	50.00	29,700
Inlet Tower	100.00	0	12,000

7. The sponsors and SCS will each bear the costs of Project Administration which it incurs, estimated to be \$50,000 and \$803,000, respectively.
8. The sponsors will obtain agreements to carry out conservation farm or ranch plans on not less than 50 percent of the land above each reservoir and floodwater retarding structure.
9. The sponsors will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed plan.
10. The sponsors will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.
11. The sponsors will be responsible for the operation, maintenance, and replacement of the works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.
12. The costs shown in this plan represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
13. This agreement is not a fund obligating document. Financial and other assistance to be furnished by SCS in carrying out the plan

is contingent upon the fulfillment of applicable laws and regulations and the availability of appropriations for this purpose.

14. A separate agreement will be entered into between SCS and sponsors before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.
15. This plan may be amended, revised, or terminated only by mutual agreement of the parties hereto except that SCS may terminate financial and other assistance in whole, or in part, at any time it determines that the sponsor has failed to comply with the conditions of this agreement. In this case, SCS shall promptly notify the sponsor in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the sponsor or recoveries by SCS under projects terminated shall be in accord with the legal rights and liabilities of the parties. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between SCS and the sponsor having specific responsibilities for the measure involved.
16. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this plan, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.
17. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 CFR 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any activity receiving federal financial assistance.
18. This agreement will not become effective until the SCS has issued a notification of approval and authorizes assistance.

By D. H. L. 6377

Title *2/10/10*

Date 20-3-2022

Sponsor _____

30.1477.

Address

Zip Code _____

By Ben Ford

Title *Chaziana*

Date 9/13/77

Sponsor

1/18/77

Address

Zip Code

By Theron E. Hooker

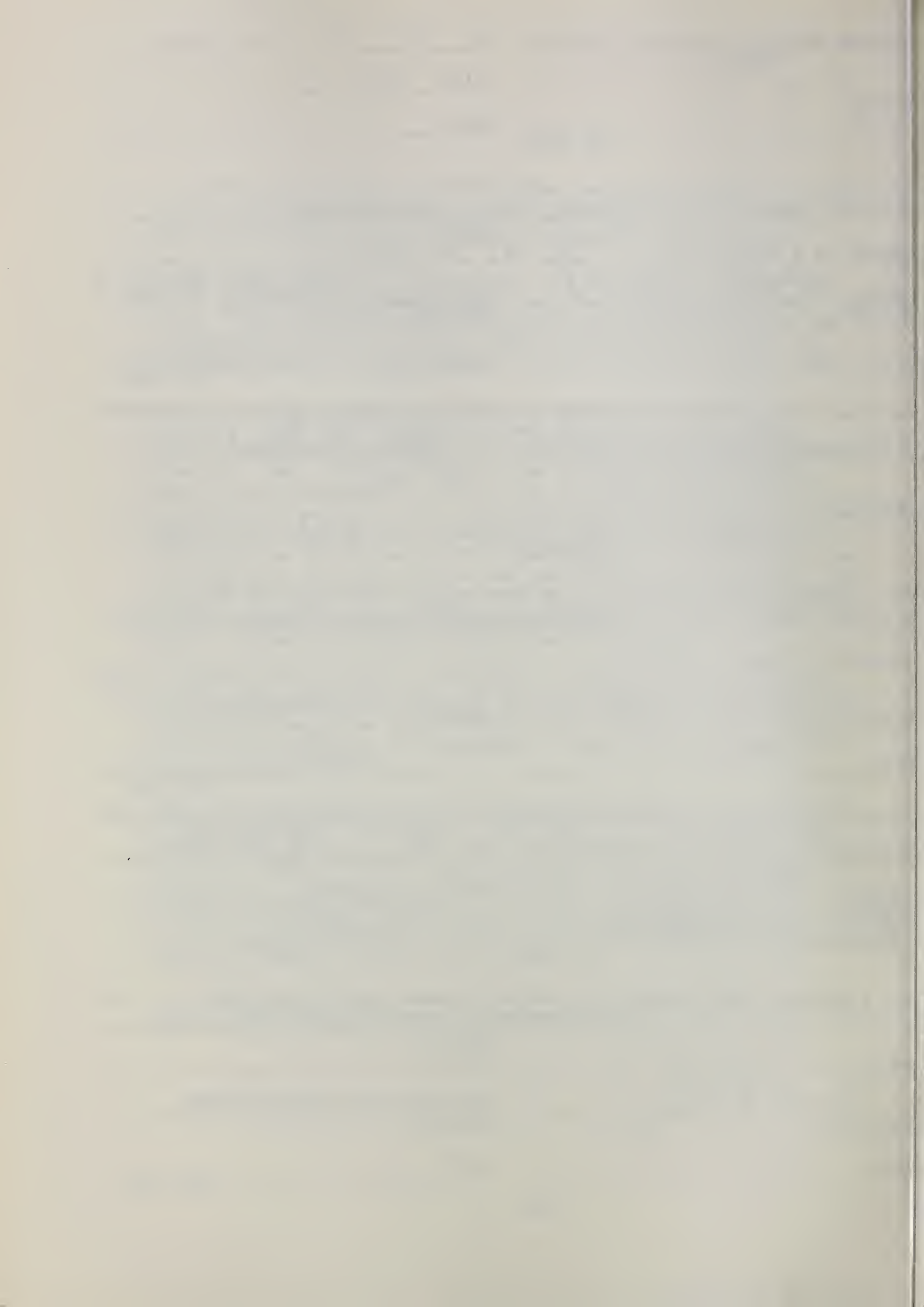
Title	Chairman
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Date 10/6/77

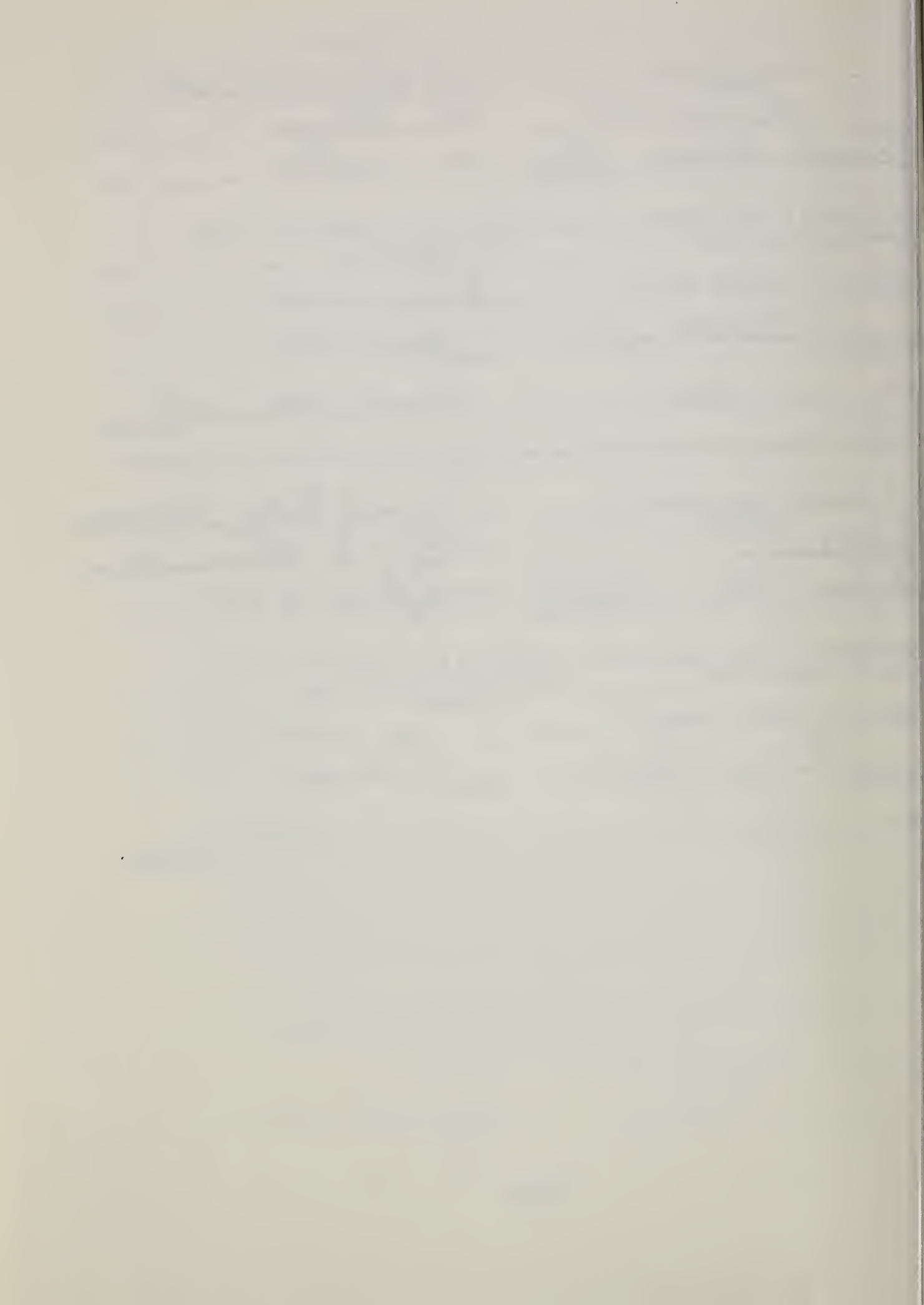
Sponsor

10/6/77

Oklahoma City, Oklahoma 73116



P-33a



Oklahoma County Commission

Sponsor

320 Robert S. Kerr

Address

Oklahoma City, Oklahoma 73102

Zip Code

By

Title CHAIRMAN

Date JANUARY 16, 1978

The signing of this agreement was authorized by a resolution of the governing body of the Oklahoma County Commission

Sponsor

adopted at a meeting held on

OCTOBER 17, 1977

Deputy

Secretary Inez Gilson

320 Robert S. Kerr

Address

Date JANUARY 16, 1978

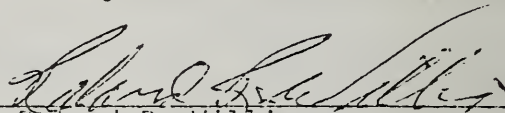
Oklahoma City, Oklahoma 73102

Zip Code

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

A handwritten signature in dark ink, appearing to read "Roland R. Willis", is written over a horizontal line.

Roland R. Willis
State Conservationist

March 16, 1978

Date

TABLE 1 - ESTIMATED INSTALLATION COST

Kickapoo Nations Watershed, Oklahoma

Installation Cost Item	Unit	Number		P.L. 566 Funds	Estimated Cost (Dollars) <u>1/</u>			Total
		Land	Land		Other Funds			
					FS <u>2/</u>	SCS <u>2/</u>	Total	
<u>LAND TREATMENT - Going Program 6/</u>								
Cropland	Acres		679			97,500	97,500	97,500
Pasture	"		11,623			514,000	514,000	514,000
Range	"		10,963			43,400	43,400	43,400
Forest	"		12,696			25,200	25,200	25,200
Urban & Misc.	"		68			3,000	3,000	3,000
Technical Assistance					2,400 <u>3/</u>	118,100	120,500	120,500
Subtotal					2,400	801,200	803,600	803,600
<u>LAND TREATMENT - Accelerated 6/</u>								
Cropland	Acres		183			26,900	26,900	26,900
Pasture	"		3,129			59,700	59,700	59,700
Range	"		2,951			52,100	52,100	52,100
Forest	"		3,418			9,800	9,800	9,800
Urban & Misc.	"		18			1,200	1,200	1,200
Critical Area Stab.								
Tree Planting	"		65	10,300		2,600	2,600	12,900
Grade Stab. Struc.	No.		1,763	1,565,700		391,400	391,400	1,957,100
Shaping and Sodding	Acres		1,980	237,600		60,000	60,000	297,600
Channel Lining	Ft.		95,500	764,000		191,000	191,000	955,000
Technical Assistance				393,170	900		900	394,070
Subtotal				2,970,770	900	794,700	795,600	3,766,370
TOTAL LAND TREATMENT				2,970,770	3,300	1,595,900	1,599,200	4,569,970
<u>STRUCTURAL MEASURES</u>								
<u>Construction</u>								
19 Floodwater Ret. Struc.				1,961,600				1,961,600
1 Multipurpose Struc.				815,530		645,470	645,470	1,461,000
Inlet Structure						115,000	115,000	115,000
Recreation Facilities				173,650		173,650	173,650	347,300
Subtotal Construction				2,950,780		934,120	934,120	3,884,900
Engineering Services				322,990		61,410	61,410	384,400
Relocation Payments				114,100		47,900	47,900	162,000
<u>Project Administration</u>								
Construction Inspection				677,500		-	-	677,500
Other				125,500		46,500	46,500	172,000
Relocation Assistance								
Advisory Services						3,500	3,500	3,500
Subtotal Project Adm.				803,000		50,000	50,000	853,000
Other Costs - Land Rights				552,000		1,349,100	1,349,100	1,901,100
TOTAL STRUCTURAL MEASURES				4,742,870		2,442,530 ^{5/}	2,442,530	7,185,400
<u>TOTAL PROJECT COSTS 4/</u>								
				7,713,640	900	3,237,230	3,238,130	10,951,770
<u>TOTAL ALL COSTS</u>								
				7,713,640	3,300	4,038,430	4,041,730	11,755,370

^{1/} Price base 1976.^{2/} Federal agency responsible for assisting in installation of works of improvement.^{3/} Forestland assistance under the going Cooperative Forest Management Program.^{4/} Excludes going program land treatment.^{5/} Includes \$2,000 Legal Fees and \$3,500 for Relocation Assistance Advisory Services.^{6/} Includes only areas estimated to be adequately protected during the project installation period.

Treatment will be applied throughout the watershed, and dollar amounts apply to total land areas, not just to adequately protected areas.

August 1977

TABLE IA - STATUS OF WATERSHED WORKS OF IMPROVEMENT

Kickapoo Nations Watershed
Lincoln and Oklahoma Counties, Oklahoma

Measure	Unit	Number Applied to date	Total Cost (Dollars) ^{1/}
<u>LAND TREATMENT</u>			
Conservation Cropping System	Acre	13,837	175,730
Contour Farming	Acre	548	329
Crop Residue Use	Acre	12,012	11,411
Diversion	Feet	245,700	221,130
Terrace	Feet	68,500	2,740
Grassed Waterway	Acre	27	3,024
Pasture & Hayland Planting	Acre	6,050	286,165
Pasture & Hayland Management	Acre	18,312	73,921
Critical Area Planting	Acre	441	67,252
Range Seeding	Acre	1,722	47,872
Proper Grazing Use	Acre	49,630	49,630
Farm Pond	No.	435	263,165
Wildlife Upland Management	Acre	55	5,500
Land Protected During Development	Acre	15	750
Tree Planting	Acre	200	5,000
TOTAL LAND TREATMENT			1,213,619

^{1/} Price base 1976

August 1977

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION
Kickapoo Nations Watershed, Oklahoma
(Dollars) 1/

Item	Installation Costs - PL-566 Funds					Installation Cost - Other Funds				Total Installation Cost	
	Construc- tion	Engi- neering	Land Rights	Relocation Payments	Total PL-566	Construc- tion	Engi- neering	Land Rights	Relocation Payments		Total Other
Multipurpose Structure 1-M	815,530	68,440	372,000	114,100	1,370,070	645,470	34,560	732,000	47,900	1,459,930	2,830,000
Inlet Structure						115,000	12,000			127,000	127,000
Recreation Facilities	173,650	14,850	180,000	-	368,500	173,650	14,850	180,000	-	368,500	737,000
Sub-Total	989,100	83,290	552,000	114,100	1,738,570	934,120	61,410	912,000	47,900	1,955,430	3,694,000
Floodwater Retarding Structures											
2	73,300	10,300			83,600			21,800		21,800	105,400
3	138,900	16,700			155,600			13,800		13,800	169,400
4	128,000	15,400			143,400			22,000		22,000	165,400
5	152,800	18,300			171,100			16,300		16,300	187,400
6	45,300	6,300			51,600			7,800		7,800	59,400
7	68,700	9,600			78,300			12,300		12,300	90,600
8	127,600	15,300			142,900			25,600		25,600	168,500
9	175,800	19,000			194,800			60,400		60,400	255,200
10	88,800	10,700			99,500			18,600		18,600	118,100
11	156,700	17,200			173,900			34,600		34,600	208,500
12	186,100	20,100			206,200			72,900		72,900	279,100
13	117,900	14,100			132,000			31,100		31,100	163,100
14	56,600	7,900			64,500			10,700		10,700	75,200
15	88,900	10,700			99,600			21,800		21,800	121,400
16	71,300	10,000			81,300			8,900		8,900	90,200
17	65,200	9,100			74,300			16,400		16,400	90,700
18	88,800	10,700			99,500			22,900		22,900	122,400
19	64,900	9,100			74,000			14,300		14,300	88,300
20	66,000	9,200			75,200			4,900		4,900	80,100
Sub-Total	1,961,600	239,700			2,201,300			437,100		437,100	2,638,400
Total--Structures	2,950,780	322,990	552,000	114,100	3,939,870	934,120	61,410	1,349,100	47,900	2,392,530	6,332,400
Project Administra- tion											
GRAND TOTAL					803,000					50,000 ^{2/}	853,000
					4,742,870					2,442,530	7,185,400

1/ Price Base 1976.

2/ Includes \$3,500 for Relocation Assistance Advisory Services.

August 1977



TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Kickapoo Nations Watershed, Oklahoma
(Dollars) 1/

COST ALLOCATION				COST SHARING					
PURPOSE				P. L. 566			OTHER		
Item	Flood Prevention	Municipal	Recreation	Total	Flood Prevention	Municipal	Recreation	Total	Recreation
Structure									
1-M	710,930	823,370	1,133,700	2,668,000	706,930		549,040	1,255,970	584,660
					4,000	823,370			1,412,030
Reloc. Costs 2/	73,220	54,370	34,410	162,000	51,570	38,300	24,230	114,100	10,180
					21,650	16,070			47,900
Inlet Structure		127,000		127,000				127,000	127,000
Recreation Fac.									
			737,000	737,000			368,500	368,500	368,500
Subtotal	784,150	1,004,740	1,905,110	3,694,000	758,500	38,300	941,770	1,738,570	963,340
19 Flood-water Retarding Structures					2,201,300			2,201,300	437,100
					437,100				
GRAND TOTAL	3,422,550	1,004,740	1,905,110	6,332,400	2,959,800	38,300	941,770	3,939,870	963,340
					462,750	966,340			2,392,530

1/ Price Base 1976

2/ Relocation costs are shared between PL-566 and other funds on the basis of PL-566 and other project costs less the relocation payments

August 1977

TABLE 2B - RECREATION FACILITIES
ESTIMATED CONSTRUCTION COSTS
Kickapoo Nations Creek Watershed, Oklahoma
(Dollars) 1/

	<u>Unit</u>	<u>Number</u> <u>3/</u>	<u>Unit Cost</u>	<u>Amount</u>
1. Roads				
a. Roadbed 20'; gravel base asphalt surface	Mile	2.6	\$ 25,000	\$ 65,000
b. Trails	Mile	2.0	1,000	2,000
2. Parking Areas				
a. Gravel base - asphalt surface	Sq.Yd.	4000	4	16,000
b. Gravel base & surface	Sq.Yd.	5000	3	15,000
3. Utilities ^{2/}				
a. Water systems, well, pump, pump house and distribution line		3	5,000	15,000
b. Electricity & Lighting				4,000
4. Sanitary Facilities ^{2/}				
a. Comfort Station and Restrooms (flush toilet), septic tanks	Each	3	20,000	60,000
5. Picnic Facilities				
a. Tables (conc. 3'x 6')	Each	30	150	4,500
b. Group Shelters (20' x 40' concrete floor)	Each	2	10,000	20,000
c. Cook Grills	Each	10	150	1,500
6. Boating				
a. Launching Ramps	Each	3	10,000	30,000
b. Passenger Dock	Each	1	7,500	7,500
7. Fishing Dock	Each	1	40,000	40,000
8. Landscaping & Vegetation	Acre	10	150	1,500
9. Fencing	Mile	8	2,500	<u>20,000</u>
Subtotal				\$302,000
Contingencies - 15%				45,300
Total Construction Costs				<u>\$347,300</u>
Engineering Services - 8.55%				<u>29,700</u>
TOTAL MINIMUM BASIC FACILITIES				<u>\$377,000</u>

1/ Price Base - 1976.

2/ Final designs and locations to be approved by State Health Department.

3/ Estimated quantities, subject to minor variations at time of detailed planning.

August 1977



TABLE 3 - STRUCTURAL DATA
Kickapoo Nations Watershed, Oklahoma

Item	Unit	Structure Number									
		1M	2	3	4	5	6	7	8	9	10
Class of Structure											
Drainage Area	Sq. Mi.	32.60	3.54	2.57	3.47	3.51	0.96	1.88	4.54	11.19	A
Curve No. (1 day) (ANC II)		75	75	75	75	75	75	75	75	75	75
Tc	Hrs.	6.83	1.87	1.45	1.82	1.65	1.25	1.80	2.87	3.33	2.21
Elevation Top of Dam 1/	Ft.	909.3	932.3	933.5	985.2	998.9	975.8	996.5	992.4	964.2	984.4
Elevation Crest Emergency Spillway 1/	Ft.	899.9	929.4	930.1	981.4	995.0	973.8	994.5	988.3	960.3	981.9
Principal Spillway Crest El. (50-yr)	Ft.	892.1	916.3	914.2	967.5	979.3	962.5	982.0	972.6	943.9	967.5
Maximum Height of Dam 1/	Ft.	64	37	40	40	39	32	30	40	38	41
Volume of Fill 1/	Cu. Yds.	855,000	105,600	128,100	122,900	155,000	39,500	66,300	141,900	172,100	90,900
Total Capacity 1/	Ac. Ft.	25,000	957	769	1,073	1,086	290	583	1,436	3,604	941
Sediment Submerged 1st 50 years	Ac. Ft.	1,113 3/	128	101	154	152	49	89	199	519	139
Sediment Submerged 2nd 50 years	Ac. Ft.	-	119	94	142	140	45	81	181	471	127
Recreation Sediment	Ac. Ft.	174	-	-	-	-	-	-	-	-	-
Municipal Sediment	Ac. Ft.	278	-	-	-	-	-	-	-	-	-
Aerated Sediment	Ac. Ft.	348	49	38	59	58	19	33	75	197	53
Recreation	Ac. Ft.	5,310	-	-	-	-	-	-	-	-	-
Municipal	Ac. Ft.	8,390	-	-	-	-	-	-	-	-	-
Floodwater Detention	Ac. Ft.	9,387	661	536	718	736	177	380	981	2,417	622
Surface Area 1/	Acre	210 3/	27	19	34	33	10	21	36	92	28
Sediment Pool (50-year)	Acre	660	-	-	-	-	-	-	-	-	-
Recreation Pool	Acre	1,070	-	-	-	-	-	-	-	-	-
Municipal Pool	Acre	1,535	106	69	104	95	36	55	125	316	89
Principal Spillway Design											
Rainfall Volume (Areal)(1 day)	In.	8.44	7.00	7.40	7.40	7.40	7.00	7.00	7.40	7.25	7.00
Rainfall Volume (Areal)(10 day)	In.	14.16	11.50	12.23	12.23	12.23	11.50	11.50	12.23	11.98	11.50
Runoff Volume (10 day)	In.	7.56	5.84	6.45	6.45	6.45	5.84	5.84	6.45	5.95	5.84
Capacity of Prin. Spwy. (Max.) 1/	cfs.	467	90	69	90	85	31	33	81	154	64
Freq. Oper. - Emer. Spwy.	% Chance	1	4	2.8	3.0	2.9	4	4	3.1	3.2	4
Dimension of Conduit	In.	54	27	24	27	27	18	18	27	36	24
Emergency Spillway Design											
Rainfall Volume (ESH)(Areal)	In.	11.45	6.40	7.82	7.82	7.82	6.40	6.40	7.82	7.74	6.40
Runoff Volume (ESH)	In.	8.24	3.62	4.88	4.88	4.88	3.62	3.62	4.88	4.80	3.62
Storm Duration	Hrs.	6.83	6	6	6	6	6	6	6	6	6
Type		Rock	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.
Bottom Width	Ft.	410	80	120	120	120	50	66	120	300	100
Velocity of Flow (Ve) 2/	Ft./Sec.	6.17	5.00	4.23	4.31	4.33	4.15	4.15	3.72	3.41	4.65
Slope of Exit Channel 2/	Ft./Ft.	.0230	.0267	.0299	.0296	.0295	.0310	.0310	.0326	.0345	.0284
Max. Water Surface Elevation	Ft.	901.8	-	931.1	982.4	996.0	-	-	989.1	960.9	-
Freeboard Design											
Rainfall Volume (FH)(Areal)	In.	27.35	9.23	12.37	12.37	12.37	9.23	9.23	12.37	12.25	9.23
Runoff Volume (FH)	In.	23.71	6.16	9.11	9.11	9.11	6.16	6.16	9.11	9.00	6.16
Storm Duration	Hrs.	6.83	6	6	6	6	6	6	6	6	6
Max. Water Surface Elevation	Ft.	909.3	932.3	933.5	985.2	998.9	975.8	996.5	992.4	964.2	984.4
Capacity Equivalents											
Sediment Volume	In.	0.64	1.31	1.42	1.60	1.56	1.84	1.70	1.57	1.66	1.55
Sediment in Recreation Pool	In.	0.10	-	-	-	-	-	-	-	-	-
Sediment in Municipal Pool	In.	0.16	-	-	-	-	-	-	-	-	-
Sediment in Detention Pool	In.	0.20	0.26	0.28	0.32	0.31	0.37	0.33	0.31	0.33	0.31
Recreation Volume	In.	3.05	-	-	-	-	-	-	-	-	-
Municipal Volume	In.	4.82	-	-	-	-	-	-	-	-	-
Detention Volume	In.	5.40	3.50	3.91	3.88	3.93	3.45	3.79	4.05	4.05	3.62

1/ May require slight adjustment in final design.

2/ Sites with no flow based on 25 percent of freeboard flow.

3/ 100-year sediment pool.

August 1977

TABLE 3 - STRUCTURAL DATA (Cont'd)
Kickapoo Nations Watershed, Oklahoma

Item	Unit	11	12	13	14	15	16	17	18	19	20	Total
Class of Structure												
Drainage Area	Sq. Mi.	6.52	12.20	4.78	1.41	2.73	1.12	1.86	2.80	1.52	2.16	104.58
Curve No. (1 day)(AMC II)		75	75	75	75	75	75	75	75	75	75	
Tc	Hrs.	2.92	4.22	1.83	1.12	1.55	0.97	0.87	0.99	1.55	1.29	
Elevation Top of Dam 1/	Ft.	977.6	923.3	936.1	902.3	917.4	944.0	891.7	906.4	882.7	883.7	
Elevation Crest Emer. Spwy. 1/	Ft.	973.5	919.4	932.3	900.3	915.4	940.4	889.0	903.9	880.7	881.6	
Princ. Spwy. Crest Elev. (50-year)	Ft.	957.4	904.4	918.4	888.7	904.0	931.5	877.5	892.3	869.1	870.0	
Maximum Height of Dam 1/	Ft.	39	40	42	29	25	22	38	34	32	34	
Volume of Fill 1/	Cu. Yds.	151,800	175,000	99,600	46,400	70,000	56,900	55,900	85,400	51,500	62,100	2,731,900
Total Capacity 1/	Ac.Ft.	1,982	3,578	1,526	441	837	331	518	780	432	591	46,755
Sediment Submerged 1st 50 years	Ac.Ft.	282	481	209	71	128	50	74	109	59	82	4,188
Sediment Submerged 2nd 50 years	Ac.Ft.	257	443	178	66	118	45	68	99	54	75	2,803
Recreation Sediment	Ac.Ft.	-	-	-	-	-	-	-	-	-	-	174
Municipal Sediment	Ac.Ft.	-	-	-	-	-	-	-	-	-	-	278
Aerated Sediment	Ac.Ft.	108	182	94	27	50	23	34	49	27	37	1,560
Recreation	Ac.Ft.	-	-	-	-	-	-	-	-	-	-	5,310
Municipal	Ac.Ft.	-	-	-	-	-	-	-	-	-	-	8,390
Floodwater Detention	Ac.Ft.	1,335	2,472	1,045	277	541	213	342	523	292	397	24,052
Surface Area 1/												
Sediment Pool (50-year)	Ac	48	94	44	17	29	14	18	30	15	19	838
Recreation Pool	Ac	-	-	-	-	-	-	-	-	-	-	660
Municipal Pool	Ac	-	-	-	-	-	-	-	-	-	-	1,070
Retarding Pool	Ac	169	364	160	49	98	40	60	88	53	72	3,683
Principal Spillway Design												
Rainfall Volume (Areal)(1 day)	In.	7.40	7.18	7.40	7.00	7.00	7.00	7.00	7.00	7.00	7.00	
Rainfall Volume (Areal)(10 day)	In.	12.23	11.86	12.23	11.50	11.50	11.50	11.50	11.50	11.50	11.50	
Runoff Volume (10 day)	In.	6.45	6.14	6.45	5.84	5.84	5.84	5.84	5.84	5.84	5.84	
Capacity of Principal Spwy. (Max.) 1/	cfs	152	222	93	30	56	27	68	65	33	66	
Freq. Oper. - Emer. Spwy.	% Chance	3.0	3.2	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Dimension of Conduit	In.	36	42	27	18	24	18	24	24	18	24	
Emergency Spillway Design												
Rainfall Volume (ESH)(Areal)	In.	7.82	7.66	7.82	6.40	6.40	6.40	6.40	6.40	6.40	6.40	
Runoff Volume (ESH)	In.	4.88	4.72	4.88	3.62	3.62	3.62	3.62	3.62	3.62	3.62	
Storm Duration	Hrs.	6	6	6	6	6	6	6	6	6	6	
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	
Bottom Width	Ft.	200	300	150	50	66	50	40	80	50	76	
Velocity of Flow (Ve) 2/	Ft./Sec.	4.45	3.79	3.78	4.15	4.35	4.35	4.80	4.67	4.15	4.35	
Slope of Exit Channel 2/	Ft./Ft.	.0290	.0322	.0322	.0310	.0300	.0300	.0277	.0282	.0310	.0300	
Max. Water Surface Elevation	Ft.	974.6	920.2	933.1	-	-	-	-	-	-	-	
Freeboard Design												
Rainfall Volume (EH)(Areal)	In.	12.37	12.12	12.37	9.23	9.23	9.23	9.23	9.23	9.23	9.23	
Runoff Volume (FH)	In.	9.11	8.87	9.11	6.16	6.16	6.16	6.16	6.16	6.16	6.16	
Storm Duration	Hrs.	6	6	6	6	6	6	6	6	6	6	
Max. Water Surface Elevation	Ft.	977.6	923.1	936.1	902.3	917.4	944.0	891.7	906.4	882.7	883.7	
Capacity Equivalents												
Sediment Volume	In.	1.55	1.42	1.52	1.82	1.69	1.59	1.43	1.39	1.40	1.36	
Sediment in Recreation Pool	In.	-	-	-	-	-	-	-	-	-	-	
Sediment in Municipal Pool	In.	-	-	-	-	-	-	-	-	-	-	
Sediment in Detention Pool	In.	0.31	0.28	0.37	0.36	0.34	0.38	0.34	0.33	0.33	0.32	
Recreation Volume	In.	-	-	-	-	-	-	-	-	-	-	
Municipal Volume	In.	-	-	-	-	-	-	-	-	-	-	
Detention Volume	In.	3.84	3.80	4.10	3.69	3.72	3.57	3.45	3.50	3.60	3.45	

1/ May require slight adjustment in final design.

2/ Sites with no flow based on 25 percent of freeboard flow.

3/ 100-year sediment pool.

August 1977

TABLE 4 - ANNUAL COST

Kickapoo Nations Watershed, Oklahoma
(Dollars) ^{1/}

Evaluation Unit	Amortization of Installation Cost ^{2/}	Operation and Maintenance Cost	Total
Bellcow Creek Multipurpose Structure 1-M	226,848	35,800 ^{3/}	262,648
Eagle Creek Floodwater Retarding Structures 2 and 3	16,876	400	17,276
Smith Creek Floodwater Retarding Structures 4 through 6	25,313	550	25,863
Wildhorse Creek Floodwater Retarding Structures 7 and 8	15,912	350	16,262
Captain Creek Floodwater Retarding Structures 9 through 12	52,867	800	53,667
Spring Creek Floodwater Retarding Structures 13 and 14	14,634	350	14,984
Pecan Creek Floodwater Retarding Structures 15 and 16	12,994	350	13,344
Kickapoo Creek Floodwater Retarding Structures 17 through 20	23,428	750	24,178
Project Administration	52,383		52,383
GRAND TOTAL	441,255	39,350	480,605

^{1/} Price Base: 1976.

^{2/} 100 years at 6.125 percent interest.

^{3/} Includes \$28,000 for operation, maintenance, and replacement for the recreational development.

August 1977

TABLE 5 - ESTIMATED AVERAGE ANNUAL
FLOOD DAMAGE REDUCTION BENEFITS

Kickapoo Nations Watershed, Oklahoma
(Dollars) ^{1/}

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project ^{2/}	
Floodwater			
Crop and Pasture	85,060	34,970	50,090 ^{3/}
Other Agricultural	61,180	3,540	57,640 ^{4/}
Nonagricultural			
Road and Bridges	39,580	4,060	35,520 ^{5/}
Urban	6,600	300	6,300
Subtotal	192,420	42,870	149,550
Sediment			
Overbank Deposi- tion	43,740	15,200	28,540
Swamping	1,900	940	960
Reservoirs	10,710	5,640	5,070
Subtotal	56,350	21,780	34,570
Erosion			
Flood Plain Scour	20,040	5,600	14,440
Indirect	21,600	6,740	14,860
TOTAL	290,410	76,990	213,420

^{1/} Price Base: Current Normalized Prices (8/74) for crop and pasture values, 1976 prices for all other values.

^{2/} Excludes effects of Land Treatment Measures.

^{3/} Includes \$9,270 in benefits to Deep Fork River floodplain.

^{4/} Includes \$46,260 in benefits to Deep Fork River floodplain.

^{5/} Includes \$16,620 in benefits to Deep Fork River floodplain.

August 1977



TABLE 6 - COMPARISON OF BENEFITS AND COSTS
Kickapoo Nations Watershed, Oklahoma
(Dollars)

Evaluation ^{3/} Unit	AVERAGE ANNUAL BENEFITS ^{1/}						Average Annual Cost ^{2/}	Benefit Cost Ratio
	Damage Reduction	More Intensive Land Use ^{4/}	Changed Land Use Agr.	Municipal Water Supply	Recreation	Employment	Total	
Bellcow Creek Multipurpose Structure 1-M	64,560	23,010	17,940	338,000	139,500	22,990	606,000	262,648 2.3:1
Eagle Creek - Floodwater Retarding Structures 2 and 3	12,960	4,040	3,090	-	-	1,910	22,000	17,276 1.3:1
Smith Creek - Floodwater Retarding Structures 4 through 6	21,890	6,000	4,770	-	-	2,920	35,580	25,863 1.4:1
Wildhorse Creek - Floodwater Retarding Structures 7 and 8	9,540	6,740	5,740	-	-	1,770	23,790	16,262 1.5:1
Captain Creek - Floodwater Retarding Structures 9 through 12	69,420	16,930	11,780	-	-	5,390	103,520	53,667 1.9:1
Spring Creek - Floodwater Retarding Structures 13 and 14	11,410	4,730	3,770	-	-	1,580	21,490	14,984 1.4:1
Pecan Creek - Floodwater Retarding Structures 15 and 16	8,840	5,080	4,470	-	-	1,460	19,850	13,344 1.5:1
Kickapoo Creek - Floodwater Retarding Structures 17 through 20	14,800	6,230	4,930	-	-	2,620	28,580	24,178 1.2:1
Project Administration							52,383	
GRAND TOTAL	213,420	72,760	56,490	338,000	139,500	40,640	860,810	480,605 1.8:1

^{1/} Price Base: Current normalized (8/74) for agricultural prices and costs. Municipal water supply based on current average cost of raw water. Employment benefits derived from 1976 construction costs. Recreation benefits determined from recreational values per recreation day published in USDA Procedures for Planning Water and Related Land Resources, March 1974.

^{2/} 1976 prices amortized for 100-years at 6.125 percent interest.

^{3/} In this project, evaluation units are also referred to as construction units.

^{4/} Includes \$16,260 in benefits to Deep Fork River floodplain.

August 1977

TABLE 7 - CONSTRUCTION UNITS

Kickapoo Nations Watershed, Oklahoma
(Dollars)

<u>Measures in Construction Unit</u>		<u>Annual</u> <u>Benefits</u> <u>1/</u>	<u>Annual</u> <u>Cost</u> <u>2/</u>
1.	Multiple-purpose Structure Site 1-M	606,000	262,648
2.	Eagle Creek - Floodwater Retarding Structures Numbers 2 and 3	22,000	17,276
3.	Smith Creek - Floodwater Retarding Structures Numbers 4 through 6	35,580	25,863
4.	Wildhorse Creek - Floodwater Retarding Structures Numbers 7 and 8	23,790	16,262
5.	Captain Creek - Floodwater Retarding Structures Numbers 9 through 12	103,520	53,667
6.	Spring Creek - Floodwater Retarding Structures Numbers 13 and 14	21,490	14,984
7.	Pecan Creek - Floodwater Retarding Structures Numbers 15 and 16	19,850	13,344
8.	Kickapoo Creek - Floodwater Retarding Structures Numbers 17 through 20	28,580	24,178

1/ Price base same as table 6.

2/ 1976 prices amortized for 100 years at 6.125 percent interest.

August, 1977



FINAL ENVIRONMENTAL IMPACT STATEMENT

KICKAPOO NATIONS WATERSHED

Oklahoma and Lincoln Counties, Oklahoma

AUGUST 1977

USDA-SCS-EIS-WS-(ADM)-77-1-F-OK

KICKAPOO NATIONS WATERSHED PROJECT
Oklahoma and Lincoln Counties, Oklahoma

FINAL ENVIRONMENTAL IMPACT STATEMENT

Roland Willis
State Conservationist
Soil Conservation Service

Sponsoring Local Organization

Kickapoo Nations Conservancy District
Wellston, Oklahoma 74881

Lincoln County Conservation District
P. O. Box 307
Chandler, Oklahoma 74834

Oklahoma County Conservation District
1016 N. W. 67th St. (Suite C)
Oklahoma City, Oklahoma 73116

City of Chandler
Chandler, Oklahoma 74834

Lincoln County Commission
County Courthouse
Chandler, Oklahoma 74834

Oklahoma County Commission
Courthouse
320 Robert S. Kerr Avenue
Oklahoma City, Oklahoma 73102

August 1977

Prepared By

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
USDA Building
Farm Road and Brumley Street
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USDA ENVIRONMENTAL IMPACT STATEMENT

KICKAPOO NATIONS WATERSHED PROJECT

Oklahoma and Lincoln Counties
Oklahoma

Prepared in Accordance with
Sec. 102 (2)(C) of P.L. 91-190

SUMMARY

- I. Final
- II. Soil Conservation Service
- III. Administrative
- IV. Description of Project Purpose and Action:

The Kickapoo Nations Watershed Plan proposes a project for watershed protection, flood prevention, municipal water supply, and recreation to be implemented under the authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83rd Congress, 68 Stat. 666), as amended. The planned works of improvement include land treatment supplemented by 19 floodwater retarding structures and one multipurpose structure designed to retard flood flows, provision of a municipal water supply, and a recreation water supply with attendant recreational facilities.

- V. Summary of Environmental Impacts:

Erosion, runoff, and flooding will be reduced, as will associated agricultural and non-agricultural damages. The project will directly benefit about 75,000 other persons in the surrounding area. Crop yields and pasture feed values will be increased, family farming operations stabilized, and net returns increased for low income farmers. Lives will be protected and employment opportunities will be created. Wildlife populations will become more stable in the floodplain due to fewer drownings of young and destruction of den areas by floodwaters and sediment. Wildlife food supplies will also be improved in the floodplain due to reduced sediment deposition and flooding. Woodland wildlife habitat and the numbers of woodland species will decrease in the uplands due to the destruction of woodland habitat in the site areas. Water oriented species including migratory waterfowl are expected to increase due to the presence of 1,698 acres of new habitat in 20 small lakes distributed throughout the watershed.

About 1,698 acres of land devoted to sediment pools, dams, and spillways will be removed from agricultural production. Of this amount, about 564 acres are in cropland, about 1,011 acres are in grassland, and 123 acres are in timber. These areas will be lost from agricultural production for the life of the project. Agricultural production on the 1,987 acres involved in the detention pool area of the structures will also be restricted during periods of high water. This restriction will exist for the life of the project. Noise, dust, erosion, and turbidity of streams will increase during the construction process. About 45,728 acres of land that has not previously been treated will receive conservation land treatment during the project period.

VI. List of Alternatives:

Alternative 1 - Accelerated land treatment.

Alternative 2 - Accelerated land treatment, 17 floodwater retarding structures, one multipurpose (flood prevention - municipal water supply and recreation) structure, and recreation facilities. (This plan satisfies the National Economic Development objectives.)

Alternative 3 - Accelerated land treatment and channel work.

Alternative 4 - Accelerated land treatment, 19 floodwater retarding structures, one multipurpose (flood prevention - municipal water supply and recreation) structure, and recreation facilities. (This alternative is the selected plan.)

Alternative 5 - Accelerated land treatment, 24 floodwater retarding structures, one multipurpose (flood prevention-municipal water supply, and recreation) structure, and recreation facilities. Acquisition and development of a 200-400 acre natural area adjacent to the multipurpose site, and acquisition and restoration of the "Bill Tilghman" house. (This plan satisfies the Environmental Quality objectives.)

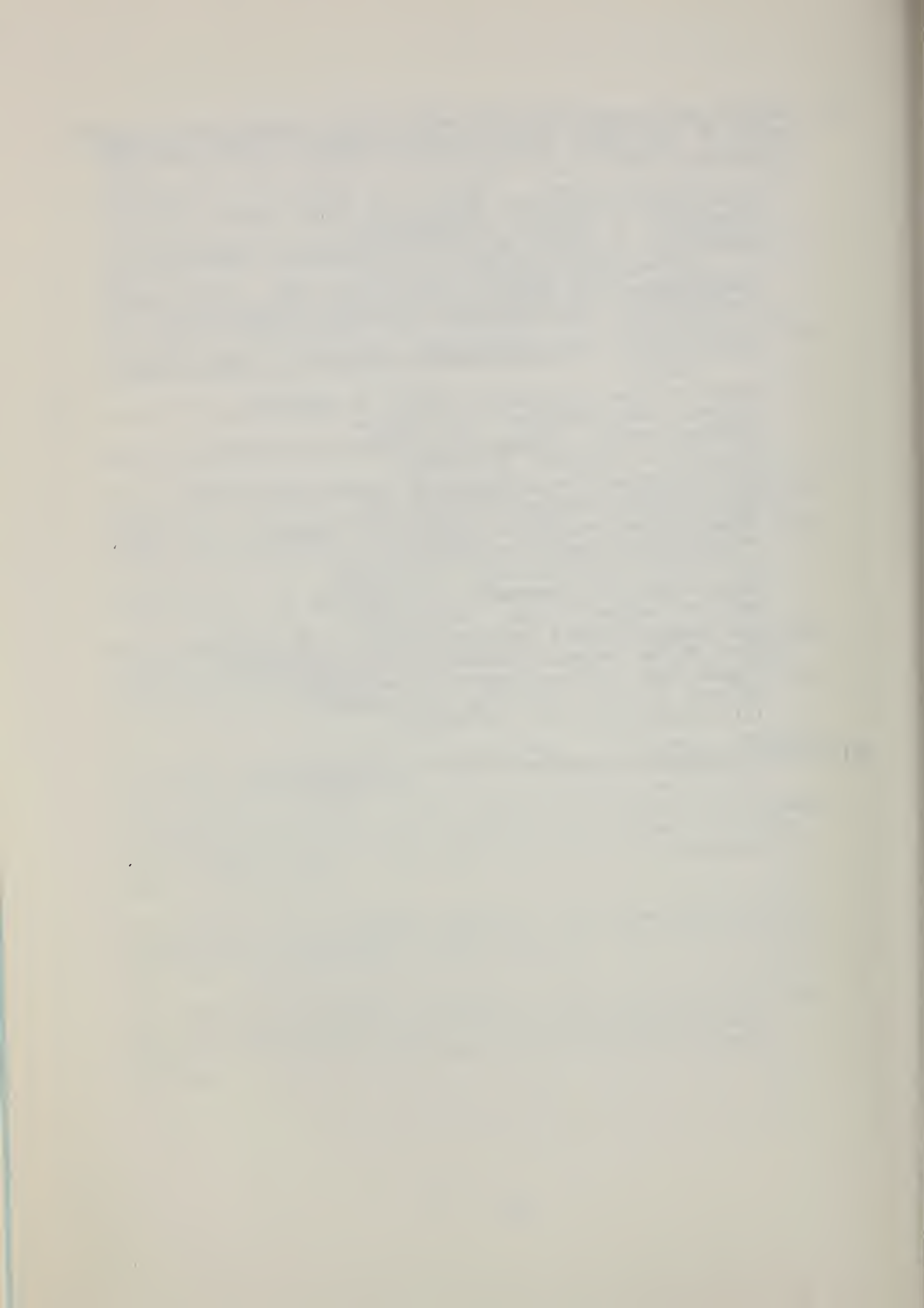
Alternative 6 - Non-structural measures - Land treatment for the upland areas and adjustment of the use of the flood prone area to those uses consistent with the flood threat.

Alternative 7 - No project - Consists of land treatment and other activities that could be carried out by the sponsors through technical and financial assistance available through on-going programs.

VII. Agencies and organizations from which written comments were requested during the Interagency review and an indication of their response is indicated below:

Department of the Army - Response by letter dated 6-20-77
Department of Commerce - No response
Department of Health, Education, and Welfare - Response by letter dated 6-10-77
Department of the Interior - Response by letter dated 6-29-77
Department of Transportation - Response by letter dated 5-22-77
Environmental Protection Agency - Response by letter dated 5-12-77
Office of Equal Opportunity, USDA - No response
Federal Power Commission - No response
Oklahoma Historic Preservation Officer - No response
Governor of Oklahoma - No response
State Clearinghouse - Response by letter dated 6-10-77
Regional Clearinghouse - No response
Natural Resources Defense Council - No response
Friends of the Earth - No response
Environmental Defense Fund - No response
National Wildlife Federation - No response
National Audubon Society - No response
Environmental Impact Assessment Project - No response
Isaac Walton League, Oklahoma Chapter - No response
Sierra Club, Oklahoma Chapter - No response
Oklahoma Wildlife Federation - No response
Tulsa Audubon Society - No response

VIII. Draft Statement Transmitted to CEQ on April 13, 1977.
Date



USDA SOIL CONSERVATION SERVICE
FINAL ENVIRONMENTAL IMPACT STATEMENT 1/

FOR

KICKAPOO NATIONS WATERSHED PROJECT, OKLAHOMA

AUTHORITY

Installation of this project constitutes an administrative action. Federal assistance will be provided under authority of Public Law 83-566, 83rd Congress, 68 Stat. 666, as amended.

SPONSORING LOCAL ORGANIZATIONS

Kickapoo Nations Conservancy District
Lincoln County Conservation District
Oklahoma County Conservation District
City of Chandler Lincoln County Commission
Oklahoma County Commission

PROJECT PURPOSES AND GOALS

The principal purposes of this plan are watershed protection and flood prevention. Municipal water supply and recreation development are added as supplements to the principal purposes. Design inclusions and mitigation actions are included to safeguard environmental values. The goals of the plan are to achieve the objectives agreed to by Sponsors, SCS, and others.

Sponsors initially described their problems as erosion, sedimentation, flooding, drainage, and irrigation. Through review of resource conditions, evaluation, and discussion, erosion, sedimentation, and flooding problems were found to be serious and widespread. Drainage problems are mainly along Deep Fork River and lower reaches of tributary streams with possible solutions subject to physical and economic limitations. While most bottomland and selected upland soils would benefit from irrigation, irrigation measures are subject to water rights, local interest, and financial limitations. Through this review and evaluation process, additional problems, needs, and concerns were identified.

1/ All information and data, except as otherwise noted, were collected during watershed planning investigation by the SCS, USDA.

A storage capacity for municipal water supplies and for recreation was identified as a need. Flooding, scour, and sediment deposition within the floodplain and channel areas were found to adversely affect habitat and mortality of some terrestrial species. Sediment transport limits benthic diversity in stream channels, moves materials from upland areas into the stream systems, and contributes directly to depressed water quality. An expression to restore and preserve the Bill Tilghman house was presented. A desire for a natural area in connection with any recreation development was expressed as well as a concern to keep the loss of woodland wildlife habitat at a minimum in formulating plans.

After identification of the above problems and needs, elements of potential plans were evaluated for their effectiveness. These elements included land treatment, structural measures, channel work, potentials for addition to municipal water supply, recreation development, and irrigation capacity. Proposals for land purchase, restoration of the Bill Tilghman house, and a variety of other actions were also considered. Tentative selections of plan components based upon effectiveness, costs, monetary benefits, land rights requirements, impacts on land use and cover, and intangibles, were made by sponsors and others. For land treatment, it was determined that financial capability of landowners and expected future cost share assistance was the limiting factor. Irrigation capacity was not included because of limited interest and funding. Drainage was not included because of physical and economic questions. Capacity for municipal and recreation water was limited to one site for financial reasons. In summary, it was not possible to fully meet erosion, municipal water supply, recreation, drainage, and irrigation objectives for reasons of financial capability.

Through this process the problems and needs (referred to as Component Needs below) to be used in formulation of alternative plans for the National Economic Development (NED) and Environmental Quality Objectives (EQ) were refined. 1/

The NED and EQ objectives are outlined below:

OBJECTIVES - NATIONAL ECONOMIC DEVELOPMENT

<u>Level 1 Components</u>	<u>Level 2 Components</u>	<u>Local Objectives</u>
Increase output of goods and services.	Reduction of flooding.	3-5 yr level of protection for 6515 acres of floodplain.

1/ Refer to Water Resources Council Principles and Standards for planning water and related land resources. Part III, Fed. Reg. Vol. 38, No. 174, Sept. 10, 1973. Washington, D. C.

<u>Level 1 Components</u>	<u>Level 2 Components</u>	<u>Local Objectives</u>
	Reduction in erosion.	Annual gross erosion reduced 15-20 percent.
	Reduction in sediment deposition.	Sediment output reduced from 171 acre ft/yr to one-half that amount (85 ac/ft).
	Reduction in constraints on municipal and industrial development.	8000 ac/ft of water for municipal and industrial water.
	Reduction in net recreation needs for water based recreation.	800 surface acres for water based recreation.
	Reduction in unemployment.	25 jobs for unemployed or underemployed individuals in the project area.

OBJECTIVES - ENVIRONMENTAL QUALITY

<u>Level 1 Components</u>	<u>Level 2 Components</u>	<u>Local Objectives</u>
Protection, management, and enhancement of land and water quality.	Reduction in flooding.	Maximum amount possible to prevent damage to dens, nesting areas and food supplies on 6515 acres of floodplain and to reduce the number of drownings of ground dwelling animals which presently occur on the average on over 5700 ac. per yr.
	Reduction in erosion and sedimentation.	171 ac/ft of sediment reduced to 43 ac/ft (75%) delivered annually to the mouth of the watershed, which damages wildlife food supplies, dens and nesting areas on 2149 ac. of floodplain, and to improve the diversity of benthic macro-invertebrates in watershed streams.

Level 1 ComponentsLevel 2 ComponentsLocal Objectives

Protection,
management and
enhancement of
land and water
quality.

Reduction in improper
land management to
broaden the resource
base.

Annual gross erosion rate
reduced 15-20 percent, and to
prevent erosion on 469 acres of
floodplain. To treat 2,138
acres of critical area which
will add new wildlife habitat
areas and prevent further
damage to present wildlife
quality aspects of the natural
resource base for sustained
use.

Acres inadequately treated
reduced from 83,600 to 37,800
acres.

81,700 acres of soil used
within its capability and
treated according to its
needs increased to 126,500
acres. Add a 200-400 acre
"natural area" in the vicinity
of the multipurpose site
for the benefit of any of the
visitors.

Reduction in loss of
forestland wildlife
habitat.

Annual loss of forested areas
reduced from 500 to 200
acres per year.

Management,
enhancement, or
preservation of
unique historical
resources.

Preservation and
enhancement of a
unique historical
site.

Purchase and restore the
Bill Tilghman homestead and
open to public.

Alternative plans as discussed in "Alternatives" were formulated in
response to the objectives and to minimize adverse impacts to the
environment.

PLANNED PROJECT

This plan includes land treatment and structural measures. Land treatment practices include those normally installed by the landowners and operators using available technical and financial assistance, and critical area treatment which requires additional financial assistance. Technical assistance is for gathering of resource information, conservation plan revision or preparation, and for measure installation. Structural measures include 19 floodwater retarding structures, one multipurpose (floodwater retarding-municipal water supply-recreation) structure with appurtenances, and fish and wildlife mitigation measures. Recreation facilities are planned at the multipurpose structure.

LAND TREATMENT

Adequate protection of land is achieved through proper management which includes installation of a combination or system of conservation practices designed for the climate, soil, and land use. Alternative combinations or systems of conservation practices described in SCS technical guides are designed to fit the physical limitations of the soil for several land uses and management levels. Typical conservation practices include conservation cropping systems, crop residue use, contour farming, diversions, terraces, grassed waterways, pasture and hayland planting, range seeding, proper grazing use, brush management, pasture and hayland management, wetland development, land protection during development, tree plantings, and critical area treatment. Critical areas include gullied and badly eroded areas located on farms and ranches and along county roads. Treatment includes shaping and filling of gullies, installation of simple grade stabilization structures (usually pipes with appurtenances), concrete chutes and channel liners, diversion terraces, shaped waterways, and vegetation (sod, planting of grass, shrubs and trees), fertilization and protective fencing.

Technical assistance is provided for soil surveys and other resource inventories needed to identify specific land treatment needs; for development of new conservation plans on individual units of watershed land; and for revision and updating of old conservation plans. The inventories will be completed, and the conservation plans will be developed through the leadership of the conservation districts with assistance provided by the SCS, the Oklahoma Forestry Division, and others. Each conservation plan will include the conservation practices agreed to by the landowner, the district, and the SCS.

Through the technical assistance provided, the watershed land will be examined for treatment needs, for adequate protection, and for efficient use. In developing conservation plans, the district, the SCS, the

Oklahoma Forestry Division, and the affected landowners will discuss the treatment area, costs, effectiveness, and cost-sharing assistance. Through this process each landowner or operator will be encouraged to install land treatment for adequate protection of his land. Fish and wildlife measures will be a part of the conservation practices considered and their installation, operation and maintenance will be encouraged.

An installation schedule will be developed by the landowner, the district, the SCS, and the Oklahoma Forestry Division. The SCS and the Oklahoma Forestry Division will provide technical assistance for installation through their cooperative program with the U. S. Forest Service. The landowner or operator will use cost-sharing assistance available through the ASCS program. PL-566 funds will be used to cost-share in critical area treatment. Cost sharing with PL-566 funds will be limited to rates authorized under other programs.

An estimated 860 acres of cropland, 14,750 acres of pasture, 13,910 acres of range, 16,110 acres of forest, and 85 acres of urban and miscellaneous lands which have not been previously treated will be treated for adequate protection during the project installation period. The acreages above include 1,955 acres of critical areas interspersed within farm and ranch land and about 90 acres along 235 miles of roadside.

STRUCTURAL MEASURES

The 19 floodwater retarding structures and one multipurpose structure are reservoir type impoundments and are designed to remain totally effective for 100 years.

Common components consist of an earth-fill dam, a reinforced concrete principal spillway, and a vegetated emergency spillway.

Reservoir Type Structures

The earth fills will range in height from 22 to 64 feet and in volume from 39,500 to 855,000 cubic yards. The earth fills will be trapazoidal in cross section with a berm or riprap on the front slope for protection from wave action. Both front and back slopes of the dams will normally be 2.5:1.0 and the top widths will range from 14 to 20 feet.

The geologic formations underlying the watershed are composed of sandstone and shale members on which have developed soils of low to medium plasticity. Soil textures include sandy and silty clays, low plastic silts, and clayey and silty sands. These materials, in different

combinations, will make up the fill materials of the dams. Structure foundations will involve soils ranging from shallow on the abutments to deep in the floodplain, all resting on typically "V" shaped rock profiles. Some sites, particularly numbers 11, 15, and 16, may have a high water table that could require a borrow area outside the sediment pool. Sites 1-M, 3, 9, and 18 may require rock excavation in the emergency spillway. Foundation or abutment drains may be needed in sites 1-M, 3, 10, 11, 12, 18, and 20. Additional sites may be included in these groups depending upon findings during the detailed geologic and foundation investigations.

The minimum area on which land rights will be acquired for the single-purpose sites will be 2,251 acres. The land area acquired for the multipurpose structure will be 2,250 acres. Of this amount, 1,070 acres will be in water surface and the remaining 1,180 acres will be open to the public for recreational purposes. Sediment and permanent pools will cover 1,698 acres, and the detention pools will temporarily inundate 1,987 acres at their maximum levels. Included in these acres are about 103 acres involved in dam and spillway areas. About 123 acres of timber will be in the sediment pools and the dam and spillway areas. Of this amount, about 40 acres will be in the multipurpose structure.

The principal spillways are made up of a drop inlet riser on the impoundment side of the dam, an outlet conduit under the dam, and an energy dissipator at the outlet of the conduit. The energy dissipator may be a plunge pool or an impact basin. The riser will be equipped with a trash guard and a valve for complete drainage of the reservoir.

The multipurpose structure will be equipped with a municipal water supply tower, outlet conduit, and control valve for diversion of the municipal water supply. This installation will be separate and apart from the principal spillway.

Principal spillway conduits are to be reinforced concrete pipe. The minimum diameter to be used will be 18 inches. The emergency spillways will be formed by a trapezoidal earth or rock cut around one end of the dam for the 19 floodwater retarding structures. They will be established to vegetation to prevent erosion with the exception of site 1-M where the spillway will be cut in rock.

The design life of each of the 20 structures is 100 years. They are each designed with capacity for sediment (9,003 acre feet total) and for floodwater detention (24,052 acre feet total). Sediment capacity is based on the expected accumulation in 100 years from the drainage area above the individual structures (total area controlled is 104.58 square miles). Floodwater detention capacity is based on routings of runoffs

from selected rainfall events through each structure. The multipurpose site will provide 5,310 acre feet of capacity for recreation water and 8,390 acre feet capacity for municipal water supply in addition to the capacity provided for sediment storage and floodwater detention. 1/

The crest of the principal spillway will normally be set at the estimated elevation of sediment accumulation at the end of 50 years. The discharge rate of the principal spillway and the floodwater detention capacity in each structure is designed to temporarily detain and to automatically release runoff from the principal spillway design storm rainfall within a 10-day period while maintaining the water level at or below the crest of the emergency spillway. The discharge rate of the principal spillway and the detention storage volume of each structure is designed to limit use of the emergency spillway to a selected frequency. There is a one percent chance that the emergency spillway of the multipurpose site will operate in any given year. The chance that the emergency spillways of the 19 other structures will function in any given year ranges from 2.8 percent to 4.0 percent.

Water may be stored in the space provided for the 50-year sediment accumulation in the 19 floodwater retarding structures until displaced by the sediment accumulation, or the landowner may elect not to store water in the site. Where initial storage of water will result in an unsatisfactory impoundment from an environmental standpoint, the crest of the principal spillway may be raised to the level required for a satisfactory impoundment. However, this elevation is limited to the elevation of the expected 100-year sediment accumulation.

Where water is to be stored above the expected 50-year sediment level, a water right must be obtained by the landowner or operator. 1/

The rock or vegetated earth spillway at each site is designed to safely pass the discharge from the emergency spillway design storm rainfall and will carry the discharge from the freeboard storm with the water level below the top of the dam.

Modification of roads, bridges, and utilities involved in the watershed include: pipelines in structure 1-M, road and bridge in structure 15. Wildlife plantings will be incorporated in the erosion control plans of nine selected structures to mitigate adverse effects on wildlife habitat resulting from construction of the project. Selected plantings of legumes, shrubs, and trees will be made in one or two acre plots totaling about 25 acres to provide food, cover, and wildlife habitat for mitigation of habitat losses. About 8 acres of this amount will be in the vicinity of the multipurpose site. These areas will be fenced for protection where needed.

1/ Oklahoma Water Resources Board Resolution adopted 1/10/61 governs principal spillway riser elevations, minimum discharge pipe capacity, and water rights in floodwater retarding structures.

The SCS will provide technical assistance for development of erosion control plans including the plantings to mitigate wildlife habitat losses. The U. S. Fish and Wildlife Service will be invited to participate in the design of the habitat plantings.

A total of 31 persons will be displaced by the project. All of these will be in the vicinity of the multipurpose site. It is estimated that a total of eight families and five farm operations will be displaced. No known minority or low income persons are included in the displaced persons.

Public access to the single-purpose site areas is not provided for in this plan. Owners of the land on which the sites are located may allow public access on an individual basis, however, neither the SCS nor the local sponsors will require it. Where public access is allowed, the landowner or operator will be responsible for providing adequate sanitary facilities as required by law.

Each construction contract will require the contractor to adhere to applicable provisions of the Clean Air and Federal Water Pollution Control Acts to minimize noise, air, and water pollution.

Occupational noise exposure will be kept to safe levels by the use of suppressant devices or through use of personal protection equipment. Standard sound level meters will be used to monitor construction activities, assuring that neither workers nor inspectors will be exposed to harmful noise levels beyond that specified by the Labor Department standards. Air, erosion, and water pollution will be held to a practical minimum by such practices as: 1) reducing the area and duration of exposure of earth fill and earth fill source areas; 2) stocking and replacing top soil on disturbed areas; 3) mulching areas likely to produce significant erosion; 4) sprinkling of earth fill source areas and other disturbed areas to minimize the production of dust; 5) scheduling and completing work by segment, where possible; 6) establishing erosion control vegetation or other pollution abatement measures as soon after work is completed as practical; 7) providing acceptable means of disposal of fuels and lubricants resulting from the operation; 8) providing sanitary facilities for disposal of sewage resulting from construction activities; 9) disposing of solid waste such as material cleared from the site, and that generated through construction activity in accordance with state regulations.

The use of pesticides and herbicides are not anticipated in the installation and operation and maintenance of this project. However, should this use become necessary, all applications will be consistent with the Federal Insecticides, Fungicides, and Rodenticides Act, as amended.

Surveys by professional archeologists and by historians have been reviewed by the state historical preservation officer and the state

archeologist. They have identified no archeological or historical values eligible for inclusion in the National Register of Historical Places that would be impacted by the project measures. One historical site, the Bill Tilghman house, was nominated for, and subsequently included in, the National Register of Historic Places. The project will not affect this site. The SCS will keep alert for archeological or historical values that might be uncovered during detailed investigations or construction. Should such values be discovered, they will be immediately reported to the state historic preservation officer and the National Park Service's Office of Archeology and Historic Preservation in Denver, Colorado, and the procedures required by PL-93-291 will be followed.

Since this is a federally assisted local project, there will be no change in the existing responsibilities of any federal agency under Executive Order 11593 with respect to archeological and historical resources.

On the multipurpose site involving recreation and municipal water, the sponsor of the development will comply with Oklahoma State Health Department regulations governing sanitary facilities and water quality control. These standards are set out in the 1973 edition of Oklahoma's Water Quality Standards.

Public Recreation Facilities

Recreational activities planned for this facility include boating, fishing, camping, and picnicking.

About 2.0 miles of trails will be developed around the lake for use in hiking or bicycling. About 4,000 square yards of asphalt parking lots and 5,000 square yards of gravel parking lots will be installed at three locations around the lake.

Three picnic areas are tentatively planned which will contain a total of two group shelters with concrete floors (20' x 40'), 30 concrete tables (3' x 6'), and 10 cooking grills. An unimproved camping area will be designated. Three wells with electric pumps will be installed to provide a sanitary source of drinking water and to provide water for three comfort stations with flush toilets which will be constructed in the vicinity of the picnic areas. Each of the comfort stations will be equipped with a septic tank and subsurface tile to serve as the waste disposal system. The system will be installed and serviced in accordance with Oklahoma Department of Health Bulletin #600. Three boat launching ramps, one passenger dock, and one fishing dock will be located so that the comfort stations will be nearby. All of the facilities will be constructed to facilitate their use by the handicapped.

About 10 acres of vegetative plantings will be installed around the facility for stabilization, screening, and improved esthetic values. These plantings will also provide some incidental wildlife benefits.

Sponsors will acquire fee simple title for all privately owned land to be used for recreation purposes in a project development where PL-566 cost sharing assistance is provided.

Rights-of-way required for public utilities, such as powerlines and pipelines needed to serve the recreational area, must be acquired by purchase or perpetual easement.

Construction of private facilities within the minimum land rights boundary is prohibited except for essential service facilities which are constructed or operated by private concessionaires on a controlled permit basis to serve the planned use of the improvement or development.

OPERATION, MAINTENANCE AND REPLACEMENT

Measures in this plan will be operated and maintained by sponsors and landowners or operators with technical assistance from local, state, and federal agencies in accordance with their delegated authorities. A specific operation and maintenance plan will be prepared for each structural measure utilizing the watershed operations and maintenance handbook adopted for watersheds in Oklahoma. The land treatment measures will be operated and maintained in accordance with the conservation plan for each operating unit.

Land Treatment

The Oklahoma and Lincoln County Conservation Districts, and the Lincoln and Oklahoma County Commissions, are each responsible for operation, maintenance, and replacement (OM&R) of the land treatment phases of this plan within their respective jurisdictions. The districts will each carry out their responsibilities for both private and public land through agreements with landowners and operators to install, operate, maintain, and replace short life elements of the treatment and adopt management measures outlined in conservation plans for each operating unit. The respective county commissions will operate and maintain the CAT work installed on county roads in accordance with the OM&R agreement developed for each specific project.

Establishment and OM&R of the critical area treatment is particularly important. Each conservation plan for farms, ranches or county road systems covering critical area treatment will include provisions for OM&R and provide for access by the district, the SCS, or other federal, state, or local agencies providing technical assistance through, or acting for, the district to inspect the measures. Each such conservation plan agreement will be signed by the responsible conservation

district, owner or operator, and the SCS, and will serve as the OM&R agreement. A period of two years after initial installation is allowed for establishment including both minor structures and vegetation components. During this period, the SCS will cost-share in repairs on the same basis as for initial installation. The critical area treatment will be inspected annually, after rain, drought, fire, or other occurrences that might adversely affect the treatment. The district, the SCS, and the Oklahoma Forestry Division will perform the inspections for the first three years. The district will make the inspections for the next seven years after which inspections will be discontinued. The district will prepare reports setting forth the conditions of the treatment and any OM&R needs after each inspection, and furnish the SCS a copy of the report. The district will follow up with landowners and operators to accomplish the OM&R needs.

Operation may include those activities, such as mowing, fertilizing, removal of debris and obstructions, which will enable the measures to function as planned. Maintenance includes timely repairs such as filling of eroded areas, replanting of vegetation, repair of concrete, pipe, or similar elements. Replacement includes replacement of short life elements, of badly damaged sections of concrete, pipe, fences, or similar appurtenances as needed for continual operation.

Establishment and OM&R of other land treatment measures are also vital in achieving the objectives of this plan. The district and the SCS will make periodic reviews of the status of installation and periodic inspections of measures installed to determine any OM&R needs. Conservation plans will be updated as needed. The district will follow up with landowners and operators to accomplish the needed work.

Technical assistance for installation and OM&R of the land treatment phase of this plan will be provided by SCS, the Oklahoma Forestry Division, and other federal, state, and local agencies, through the Oklahoma County and Lincoln County Conservation Districts, in accordance with agreements between the agencies and the districts.

Landowners and operators and county commissioners will operate, maintain, replace elements of the land treatment and bear the costs incurred. The district may lend, rent, or perform part of the work with district equipment and manpower. Cost-sharing assistance available through the ACP or other federal programs may be utilized as available.

Structural Measures

The Oklahoma County and the Lincoln County Conservation Districts, and the City of Chandler will operate and maintain the structural measures including appurtenances and the associated wildlife mitigation measures.

They will replace worn or inoperative elements when needed. The Oklahoma County Conservation District is responsible for operation, maintenance, and replacement on sites 4 through 8. The Lincoln County Conservation District is responsible for OM&R on sites 2, 3, and 9 through 20. The City of Chandler is responsible for OM&R on multipurpose structure 1-M including the recreation development associated with that site.

Operation of the structural measures, appurtenances, and associated wildlife mitigation measures will include management to insure that these measures perform the functions for which they were planned. For the reservoir structures, this will consist of actions to prevent the principal and emergency spillways from being altered or obstructed and to insure that water quality in connection with the multipurpose structure remains suitable for municipal water supply and recreation purposes.

It is particularly important that the spillway areas, the floodwater detention storage areas and the recreation facilities area be kept free of unauthorized buildings, fences, roads, and the like, that might impair the operation of the structures or the recreation development. The City of Chandler understands that the lands acquired in fee title for multipurpose site 1-M, and the recreation development are to be kept from private development except for essential service facilities which may be constructed or operated by private concessionaires on a controlled permit basis to serve the planned use of the improvement or development.

Operations of the multipurpose structure site 1-M will involve the withdrawal of water for municipal water supply purposes, and the maintenance of the recreation pool above elevation 881.2 feet MSL. Operation studies which took into account water yield from the drainage area above site 1-M, maximum water supply demands, and evaporation and seepage losses show that the water level of the reservoir can be maintained above elevation 881.2 feet MSL. The City of Chandler will notify SCS through the state conservationist, if drawdown below the specified elevation is necessary. If it is determined that there is a continuing need for the use of recreation storage for municipal water supply purposes, the City of Chandler will reimburse the federal government for all of the PL-566 funds used for the recreation development associated with that reservoir. Operation of the recreation facilities and the recreation development includes custodial, sanitation, policing, safety, and similar services, and a frequent check of the facilities and their use to insure that the development is functioning as planned. Collection and disposal of solid waste in connection with operation and maintenance of the recreation facilities will be handled by the City of Chandler Sanitation Department in the same manner as for the City.

The City of Chandler will comply with Oklahoma State Health Department and Federal regulations governing sanitation, water quality, or chemical usage, in connection with the multipurpose reservoir and the recreation

development. The Oklahoma State Health Department and the City of Chandler will jointly monitor sanitation and water quality. The County Health Department will monitor sanitation in connection with the recreation area.

The sponsors and landowners or operators will operate and maintain fish and wildlife mitigation measures included in the plan. Wildlife mitigation areas will normally be fenced so that grazing or other uses may be restricted. The Oklahoma Department of Wildlife Conservation, the U.S. Fish and Wildlife Service, and the SCS will provide technical assistance in the operation and maintenance of the fish and wildlife resources in the watershed.

Maintenance of the earth dams, principal and emergency spillways, and reservoir areas, includes such items as: replacement of soil removed by rodents; clean out of relief wells and drains; repair of damaged riprap; stabilization of slide areas; maintenance of dikes and fills at proper elevation; replacement of eroded material in spillways and on dams and perimeter areas; immediate revegetation as needed, and mowing as well as control of undesirable vegetation, fertilizing, and controlled grazing; and removal of trash and debris likely to clog spillways or adversely affect operation. Maintenance of the recreation development includes many of the above items, and in addition, timely repairs of the facilities to correct problems resulting from vandalism, normal use, and natural occurrences.

Replacement in connection with all structural measures includes replacement of badly damaged elements and short life elements at the end of their useful life. Examples include replacement of fences, relief well casings, and drains, trash racks, gates and valves, risers, picnic tables, and other recreation facilities.

Annual operation, maintenance, and replacement costs are estimated to be \$39,350, of which \$28,000 is for the recreation development including replacement of the facilities. It is expected that much of the routine OM&R in connection with the 19 floodwater retarding structures will be performed by the landowner or operator on whose land the structure is located. The respective conservation districts will secure any funding needed for OM&R of the single purpose structures, appurtenances, and fish and wildlife mitigation measures through donations from revenues for services they provide, and tax revenues raised by the Kickapoo Nations Conservancy District. The City of Chandler will secure funding for OM&R in connection with multipurpose structure 1-M and the recreation development from its regular source of revenue. The city does not plan to impose use charges. However, should they later find this action necessary, any use charges will be limited to that required to repay their investment, and for operation and maintenance for the recreation development.

Specific operation and maintenance agreements between the SCS and the sponsor responsible for each structure will be executed prior to signing a landrights, relocation, or project agreement. The OM&R agreement will detail specific operation and maintenance responsibilities of sponsors and will include specific provisions for retention, use, and disposal of property acquired or improved with PL-566 cost-sharing.

Upon completion of installation, including development of associated wildlife areas, the sponsors will accept the structures for operation and maintenance. A three-year period is allowed for establishment of vegetation. During this period, any required revegetation will be cost-shared with PL-566 funds on the same basis as for the initial installation. PL-566 funds shall not be used to make repairs or correct problems resulting from poor operation or maintenance, or for replacement of short life elements of the structures.

Operation, maintenance, and replacement for the measures included in this plan have been discussed between the sponsors and the SCS and the sponsors understand their obligations.

To guide or monitor operation and maintenance, inspections will be made annually, after unusually severe floods, and after occurrences of any other unusual condition that might adversely affect the structural measures. These inspections will be made by the sponsors and the SCS for the first three years, and by the sponsors thereafter. The sponsors will prepare reports of the inspections detailing the need for operation, maintenance, and replacement, and provide SCS with a copy.

The sponsors will take such action as needed to accomplish the needed work. The SCS and other local, state, and federal agencies will provide technical assistance in accordance with their delegated responsibilities and authorities.

Project Costs

The project costs are shown in the following table:

<u>Item</u>	<u>Costs (dollars)</u>		
	<u>P.L. 566</u>	<u>Other</u>	<u>Total</u>
Land Treatment		803,600	803,600
Accelerated Critical			
Area Treatment	2,970,770	795,600	3,766,370
Structural Measures	4,742,870	2,442,530	7,185,400
TOTAL PROJECT	7,713,640	4,041,730	11,755,370

Construction costs from PL-566 funds will amount of \$2,950,780 and other funds will provide \$934,120 toward construction for a total of \$3,884,900.

ENVIRONMENTAL SETTING

Physical Resources

The Kickapoo Nations Watershed drains 165,300 acres (258.28 square miles) in central Oklahoma. About 80 percent of the watershed is in Lincoln County and the remaining 20 percent is in Oklahoma County. The watershed is composed of eight named and several unnamed tributaries to the Deep Fork River. All of these tributaries are classed as intermittent streams. The named tributaries include Smith, Wildhorse, Captain, Spring, Pecan, and Kickapoo Creeks on the south and Eagle and Bellcow Creeks on the north side of the river.

Towns located within the watershed and their 1970 populations are: Chandler, 2,529; Luther, 836; Wellston, 789; and Warwick, 146. The western edge of the watershed lies about 16 miles northeast of downtown Oklahoma City. The population in the watershed is primarily rural. In recent years the population has increased as people who work in the Oklahoma City metropolitan area have moved to small acreages in the watershed.

The watershed is in the Lower Canadian River Basin of the Arkansas-White-Red Region as delineated by the Water Resources Council. The Lower Canadian River Basin extends from the eastern edge of the Texas panhandle across central Oklahoma to its juncture with the Arkansas River in east central Oklahoma. The watershed is located in the Cross Timbers Land Resource Area which extends north and south across the east central part of the Lower Canadian River Basin.

The Cross Timbers Land Resource Area, within which the watershed lies, is a large wooded area of rolling to hilly sandstone uplands extending from the Kansas line to Texas. It is an area of scrubby timber in which old growth is more or less open and park like. Cutting and burning have caused prolific sprouting of the post oak and blackjack oak to form many brushy thickets. The slopes are quite steep and divides rather narrow. Steeper slopes generally follow east-facing escarpments. The watershed lies in a portion of the Cross Timbers area which is less ridgy and does not rise so distinctly above the surrounding prairies as that to the east which is underlain by harder sandstones. Surface elevations range from 1,300 feet in the northwest to about 900 feet mean sea level in the southeast. Trees are usually found on the soils developed from sandstone, while the clay soils developed on shales tend to support grasses. Prairie openings usually occur on clayey lower slopes or clay knobs which locally rise above the wooded hills (15). 1/

1/ Numbers in parenthesis at the end of a sentence indicate the reference number in the bibliography.

There are two principal soil and water resource problem areas within the watershed. One is composed of floodplain areas totalling about 6,515 acres which are subject to frequent and severe flooding. The second problem area involves about 132,000 acres of upland which is subject to extensive sheet and gully erosion. Most of the upland soils are medium textured, slowly permeable to permeable, and moderately productive. The floodplain soils are mostly medium textured, permeable, and are very productive. Some high terraces are found adjacent to the floodplain. These terraces contain soils which are permeable, medium textured, and are moderately to highly productive (16).

The floodplain soils have developed from Recent alluvium while the soils on the high terraces were formed from Pleistocene deposits. The upland soils were formed over sandstones, shales, and mudstones of Pennsylvanian age (2).

A soil association represents an area on the landscape and consists of one or more dominant soils for which the unit is named, though it may include small, scattered areas of other soils. There are four soil associations in the watershed; Port-Pulaski soils are deep, level, or nearly level, loamy soils found on the floodplains; Darnell-Stephenville soils are very gently to strongly sloping, loamy soils which range from very shallow to deep over sandstone found on forested uplands; Renfrow-Vernon-Bonham soils are very gently sloping to moderately steep, loamy soils which range from shallow to deep over clay or shale found on prairie uplands; Konawa-Dougherty-Teller soils are deep, nearly level to strongly sloping, sandy to loamy soils found on the high terraces along the flood plains (16). These soils are generally moderately leached, light colored, moderately acid, and have reddish, sandy, clay loam subsoils. Considerable invasion of oaks have occurred in the past half century, particularly on the moderately deep to very shallow soils. These soils are generally very low in phosphorus and nitrogen and low in potassium and calcium (15).

The watershed has a climate characterized by pronounced day-to-day changes in the weather but only gradual seasonal changes. Spring and autumn months are mild with warm days and cool, pleasant nights. Summers are usually long and hot, and winters are comparatively mild and short.

The watershed lies in the sub-humid climatic zone. Average daily maximum temperatures range from around 48 degrees in January to 95 degrees in July and August, while daily minimum temperatures average about 28 degrees in January and 70 degrees in July and August. The lowest temperature recorded in the watershed is -20 degrees and the highest is 118 degrees. The average annual growing season of 210

days extend from April 1 to October 29. The average annual precipitation recorded at Chandler is 34.4 inches (2).

The watershed is in the Oklahoma Water Resources Region VIII. The value of produced mineral resources in this Region in 1968 amounted to about 185 million, most of which was from oil and gas. Cement, chemical and agricultural quality lime, coal, copper, manganese, volcanic ash, sand, gravel, and the raw materials for the production of glass and bricks are all found in Region VIII. However, none of these materials is presently found in the watershed in sufficient quantities for economic production with the exception of oil and gas (2). Sand pits could also be developed in the area, but none are presently operating in the watershed.

Well water in the watershed is obtained from alluvium deposits along the major streams or from the Garber-Wellington or Vamoosa formations. Yields of 150-250 gpm (gallons per minute) can be expected from the alluvial deposits while the Garber-Wellington will yield up to 400 gpm, although 200 gpm is average. The Vamoosa Formation also supplies about 200 gpm in most wells.

A large part of the watershed (about 95 percent) is underlain by shale, siltstone, and sandstone. Wells in these rocks commonly yield from less than one gpm up to as high as 20 gpm from the thicker, fractured, sandstone layers. About one out of five wells drilled into these will not yield enough water for household use, or yields water too highly mineralized for most purposes (2).

The chemical quality of groundwater from the Garber-Wellington and Vamoosa formations is generally good and the water is suitable for most uses. Dissolved solids concentrations of water from the Garber-Wellington range from about 100 to 500 ppm (parts per million). The water is generally of the calcium magnesium bicarbonate type in the watershed. Water from the Vamoosa Formation has dissolved solids concentrations which range from about 300 to 1,500 ppm. Hardness and sulfate are the most troublesome chemical characteristics of the water from this formation (2).

The chemical quality of groundwater from the alluvium is generally fair to good. Dissolved solids concentrations range from 190 to about 2,800 ppm. Hardness is the most troublesome chemical characteristic of water in the alluvium; several samples contained more than 500 ppm (2).

The land use of the watershed is:

<u>Land Use</u>	<u>Acres</u>	<u>Percent</u>
Cropland	17,526	11
Tame Pasture	41,330	25
Range	57,536	35
Forest	46,745	28
Miscellaneous	<u>2,163</u>	<u>1</u>
Total	165,300	100

Floodplain land use is:

<u>Land Use</u>	<u>Acres</u>	<u>Percent</u>
Cropland	3,314	51
Tame Pasture	1,672	26
Range	579	9
Forest	429	6
Miscellaneous	<u>521</u>	<u>8</u>
Total	6,515	100

Surface water in the watershed is located in Chandler and Warwick Lakes, numerous farm ponds, 287 miles of intermittent streams, and the section of the Deep Fork River which passes through the watershed.

The Deep Fork River originates in Oklahoma County in central Oklahoma and flows generally eastward for about 100 miles to its confluence with the North Canadian River in what is now Eufaula Reservoir. Kickapoo Nations watershed is located about 25 miles east of the upper extremity of the Deep Fork River watershed and includes about fifteen miles of the river and eight of its principal tributaries. Two of the tributaries enter the river from the north and six from the south.

The segment of the Deep Fork River directly affected by this project is a man-altered, perennial stream. The tributaries have both natural and man-altered channels and flows are intermittent in lower reaches and ephemeral in the upper reaches.

The water quality for the Deep Fork River and Bellcow, Kickapoo, and Captain Creek tributaries has been established by the Oklahoma Water Resources Board. The water has been designated for use in public and private water supplies; fish and wildlife propagation; agriculture; industrial and municipal cooling water; receiving, transporting,

and/or assimilating adequately treated waste; recreation (primary and secondary body contact); and aesthetics.

Surface water quality is variable in the region. Two testing stations have been located in the watershed. One on Captain Creek near Wellston collected water samples periodically from 1954-57 and the other, located on the Deep Fork River near Chandler, took samples periodically from 1949 to 1954. Sampling stations were also located on Dry Creek near Kendrick in the adjoining watershed to the east and on Quapaw Creek near Meeker in the adjoining watershed to the south. The water quality data for these locations is presented in the following table (2).

MAXIMUM AND MINIMUM QUALITY VALUES

Station	(SO ₄)		(Cl)		(NO ₃)		(B)	
	Sulfate		Chloride		Nitrate		Boron	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Captain Creek near Wellston			52.0	21.0				
Deep Fork River near Chandler	100	19.0	300	74.0	25.0	0.2		
Quapaw Creek near Meeker			292	38.0				
Dry Creek near Kendrick	19.0	7.0	158	0.6	3.5	0.3	.08	.03

Station	Dissol'd Solids		Hardness as Ca CO ₃		Sodium Adp. Ratio		Specific Cond.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Captain Creek near Wellston			300	194	1.2	0.5	659	442
Deep Fork River near Chandler			480	178	4.5	1.5	1580	546
Quapaw Creek near Meeker			328	100	4.1	1.1	1370	469
Dry Creek near Kendrick	440	81	240	34	2.2	0.0	792	79

The maximum readings shown in the above tables were obtained from samples taken during periods of low flow when chemical concentrations are greatest. Since they do not exceed Oklahoma Public Health Service recommendations, it is apparent that surface water quality in the watershed is suitable for most uses as measured by these parameters.

There are no wetland areas as defined in Circular 39 of the U. S. Department of the Interior, Fish and Wildlife Service in the watershed.

Present and Projected Population

The population distribution in Lincoln County in 1970 was 26.3 percent urban and 73.7 percent rural. In Oklahoma County, where about 20 percent of the watershed lies, the population is 97.4 percent urban and 2.6 percent rural. Census figures for 1970 indicate a 5.1 and 1.4 percent migration into Oklahoma and Lincoln Counties, respectively, since 1960. In 1970, the Lincoln County population was 19,482 (20 per square mile) and the Oklahoma County population was 526,805 (754 per square mile) (6). By the year 2020 the population of Lincoln County is expected to be 36,215 (37 per square mile) and Oklahoma County is expected to be 979,290 (1,399 per square mile)(6).

The population of the watershed is about 6,000 and is expected to increase rapidly. The part of the watershed which is in Oklahoma County, and bordering areas of Lincoln County, is rapidly being divided into 5 to 10 acre plots and developed for housing by people employed within the metropolitan area of Oklahoma County.

Of the total population in Lincoln County in 1970, 858 or 4 percent, were black. In Oklahoma County, 52,808, about 10 percent, were black and another 9,482 or 1.8 percent, were of Spanish descent (6).

Economic Resources

The farms and ranches in the watershed are privately owned. There is no federal land within the watershed.

The major farm or ranch enterprise is beef production. The primary use of cropland is for growing feed in support of the livestock industry. There are about 785 farm and ranch units in the watershed. The size of these units ranges from about 40 to 1,700 acres. However, most fall in the 160 to 320 acre size.

The primary crops grown on the floodplain are grain sorghum, wheat, and alfalfa. Alfalfa is grown only on the floodplain. Sorghums grown on the uplands are used primarily for forage.

The principal use of the uplands is for livestock grazing. Some of these upland grazing areas have been planted in tame grasses. About 28 percent of the area is classified as forest land with grasses and growth of blackjack and post oaks interspersed. The forest land produces firewood and is important for grazing.

In 1969, the market value of land ranged from \$75 to \$150 per acre for upland and from \$150 to \$300 per acre for bottomland. Urban lots, 25 feet by 140 feet, located in areas that have been flooded, are offered for sale at \$500 but are difficult to sell at this price according

to local realtors. Lots of the same size outside the flood plain area sell readily at \$1,000 each.

The system of federal and state highways and county roads serving the watershed is adequate to provide ready access to markets for watershed residents. Many of the county roads have been hard surfaced or gravelled.

The watershed is in an area having "substantial unemployment." That is, unemployment is equal to 6 percent or more of the total work force, discounting seasonal or temporary factors.

The Chandler Baseball Camp west of Chandler was organized in 1956. This well known camp provides baseball instruction to many youths each year. The camp provides a seasonal stimulus to the economy of the watershed area.

Fish and Wildlife Resources

The watershed is situated in a forest-grassland or savanna ecotone between the deciduous hardwood forests of eastern Oklahoma and the open grasslands of western Oklahoma. Wildlife habitat in the watershed exhibits characteristics of both areas.

The post oak-blackjack plant community occurs on almost 47,000 acres of upland, or about 28 percent of the watershed. The overstory is largely composed of post oak, blackjack oak and black hickory. The understory is made up of big bluestem, little bluestem, greenbrier, and other grasses, vines, and shrubs. The principal game species in this habitat are bobwhite quail, fox squirrel, cottontail rabbit, and a few whitetail deer. Furbearers and predators found here include raccoon, striped skunk, opossum, and coyote. Various bird species avail themselves of this habitat, including bluejays, crows, flickers, chickadees, titmice, and to a lesser degree, numerous songbirds, hawks, and owls.

The tall grass plant community occupies about 57,500 acres, or about 35 percent of the watershed. Dominant species of grasses in this community include big bluestem, little bluestem, Indiangrass, switch grass, and silverbeard bluestem. The value of the grassland habitat is dependent largely upon its distribution in relation to the post oak-blackjack habitat since the same wildlife species utilize both types of habitat. Those grassland areas with tree cover nearby comprise an important habitat component.

More than 41,300 acres, or about 25 percent of the watershed, is planted to bermudagrass or other introduced grasses. Habitat values for all species of wildlife are low on this area.

About 17,500 acres, or 11 percent of the watershed, is utilized as cropland. The principal crops grown are grain sorghum, wheat, and alfalfa. The cropland provides a food source for many wildlife species but has little value for cover, nesting, or denning. The usefulness of this area for wildlife depends upon the location in relation to other habitat types in the watershed.

A small but important area of wildlife habitat in the watershed is the bottomland hardwood plant community found adjacent to the stream courses. This community occurs on alluvial soils which are subject to intermittent flooding. It represents less than two percent of the watershed area or about 1,957 acres. Trees found in this habitat type include American elm, hackberry, cottonwood, sycamore, post oak, blackjack, and pecan, along with other species. Wildlife species utilizing this habitat are essentially the same as those on upland areas with the exception of mink, muskrat, beaver, and a greater diversity of bird species.

Although most of the watershed is privately owned, a considerable amount of hunting occurs here. Dove, quail, rabbit, deer, and squirrels are the heavily hunted species. Raccoon, duck, and coyote are also hunted occasionally.

There are about 465 surface acres of fish habitat in the watershed. About 250 acres of this amount is in Chandler and Warwick lakes and the rest of the area is in farm ponds and the Deep Fork River and the lower reaches of the major tributaries. Water quality for fish production is generally good.

Common fishes found in the watershed include largemouth bass, green sunfish, carp, bluegill, black bullhead, golden shiner, common shiner, the redbfin shiner, and channel catfish.

Both herbicide spraying and mechanical clearing have reduced the acreage of upland hardwoods in recent years and the vegetal cover has changed from woody to herbaceous. Weeping lovegrass, bermudagrass, and native grasses are the primary plant species replacing the woody vegetation. Many of the bottomland hardwood areas have been cleared and converted to cropland or tame pasture. Present trends indicate that the timber clearing is continuing at a decreasing rate.

Since the entire watershed is within easy driving distance from the metropolitan areas of Oklahoma City, many city dwellers utilize both the fishery and hunting resources of the watershed throughout the year.

Recreational Resources

Recreational resources within the watershed are limited. In addition to the hunting and fishing discussed above, the only other outdoor recreational opportunities are afforded by the Chandler golf course and a 35 acre recreational lake near Warwick.

Within a one-hour drive of the watershed are five water-based outdoor recreation facilities with a combined surface area of about 40,000 acres. Facilities available include cabins, campsites with utilities, sanitary facilities, picnic tables and grills, swimming beaches, and marinas with rental boats and motors. Recreational opportunities afforded by these facilities include camping, hiking, bird-watching, picnicking, swimming, boating, waterskiing, hunting, and fishing.

However, all existing water-based recreation developments in the vicinity of the watershed are intensely utilized and both a need and a potential exists for one or more such developments in association with flood-water retarding structures in Kickapoo Nations Watershed.

There are also at least seven eighteen-hole public golf courses within a one-hour drive of the watershed.

Archeological, Historical, and Unique Scenic Resources

Two professional archeological consulting firms surveyed separate areas of the watershed to locate and identify historical or archeological sites. (4, 5)

A total of 15 such sites were identified. Three of the sites were historic, 2 showed evidence of both historic and pre-historic occupation, and 10 sites were tentatively identified as pre-historic. One of the historic sites was the homestead of Marshall William M. Tilghman, a well-known frontier marshall. This site was nominated to the National Register of Historic Places and has since been included in the Register.

The director of the Historical Sites Division of the Oklahoma Historical Society reports that one other historical site, Camp Alice, is located in the watershed. Camp Alice, an 1883 camp of David Payne's Boomers, is located in the SW¼ of Section 16, Range 13N, Township 1W.

There are no unique scenic areas in the watershed.

Soil, Water, and Plant Management Status

The trend in land use in recent years has been a decrease in cropland, rangeland, and forestland, and an increase in tame pastures and house locations. Many people from the Oklahoma City area are buying five to ten acre tracts and building a home. This trend is expected to continue and to result in the largest change in land use in the watershed.

In spite of the increased awareness of conservation needs by landowners and operators, committed factors of production (land, labor, capital) are employed inefficiently on much of the upland and on the floodplain. Much of the rangeland is in poor condition. This condition is largely a result of poor management practices which contribute directly to inefficient agricultural operations. Inefficient use of the floodplain area is due primarily to flooding and sediment deposition.

The Lincoln County Conservation District and the Oklahoma County Conservation District provide assistance to landowners and operators in their respective counties. The 787 operators in the watershed have developed 533 conservation plans. About 64 percent of the watershed is covered by conservation agreements and about 64 percent of the planned land treatment measures have been installed on the land. An estimated 48 percent of all land treatment measures needed in the watershed have been applied.

The following amounts of land, classified by use, are considered to be adequately treated:

<u>Land Use</u>	<u>Acres</u>
Cropland	13,667
Tame Pasture	17,429
Range	31,084
Forest	17,515
Miscellaneous	<u>2,035</u>
Total	81,730

Projects of Other Agencies

There are no projects of other agencies in, or planned for, the project area. Projects outside the watershed which are directly or indirectly affected by the planned project include the proposed Arcadia Reservoir, a project of the Corps of Engineers to be located on the Deep Fork River about 10 miles upstream from the western boundary of Kickapoo Nations Watershed. This project will provide flood protection to the floodplain of the Deep Fork River and will be complemented by the Kickapoo Nations Watershed project.

The Eufaula Reservoir, also a project of the Corps of Engineers, is located on the Canadian River, below its juncture with the Deep Fork River. The Kickapoo Nations Watershed project will impact on Eufaula Reservoir through a reduction in sediment deposition.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land and Water Management

The major problems within the watershed are due to misuse of the land. In past years, a major portion of the upland area was cultivated. Erosion became a problem in the uplands before the soil conservation movement got started and it still continues to be a problem. Over the years much of the top soil eroded away, and, as the remaining subsoil was infertile, crop yields decreased rapidly. A great deal of this cropland was abandoned and returned to native grass through the stages of plant succession.

The present major agricultural enterprise in the watershed is livestock production. Many of these "native grass" areas were grazed nearly from the time that cropping ceased. Consequently, large areas are still at the lower end of the plant succession scale and few of the high quality perennial native grasses are present. Continued overuse has prevented the establishment of perennial species on large areas and active erosion is still occurring in many places.

The inefficient use of committed factors of production is very evident in this watershed. Production costs remain the same regardless of yield. In much of this upland area production from the low quality range or pastured areas is limited. About 48 percent of the watershed is in pasture, range, or forested range which is inadequately treated. Taxes are paid each year on these acres which produce very little income compared to their potential.

There are about 2,138 acres of critical sediment source areas scattered throughout the watershed whose present erosion is one of the main watershed problems. Many of these areas involve more than one landowner. Many of them have also become so big that the average operator cannot afford adequate control measures. Consequently, the problem continues to grow. Many of the smaller areas have been treated in the past, and many are still being treated under the going program. Of the approximately 384 problem areas remaining, 338 are so serious that the individual owners or operators cannot take action without outside financial assistance.

Labor could be more efficiently utilized if these areas could be made more productive, or at least stabilized so that they would not continue to destroy productive land. If these areas were stabilized, a larger labor force would be required and this would effect community development and local businesses.

Another land management problem in the watershed is flooding. If flooding occurs in the spring, planting is delayed. Attempts to plow too early when the soil is wet have resulted in the destruction of soil structure and poor soil tilth. Planting late often results in poor stands. Flowering and seed set occurs during the seasonal dry period when blooms are often dropped and fewer seeds are formed. Shrunken and light weight seed result. The overall quantity and quality of most field crops are reduced. If flooding occurs in the summer or fall, the crop is destroyed or severely damaged and harvests are delayed.

Another major land management problem is sediment deposition on the floodplain. Sediment destroys growing or newly seeded crops the same as floodwater. Since most of the sediment is now from the infertile upland subsoil, fertility of the floodplain is reduced. Sediment often accumulates to such depths that landowners remove it from around pecan trees to prevent their death. Soil structure is nonexistent and yields are very low from newly deposited sediment areas.

Because of these limitations, many farmers and ranchers have a low return on their investment. Consequently, they are unable to make needed improvements even though they realize they would benefit from them.

Floodwater Damage

The combined floodplain areas of eight evaluated creek tributaries to Deep Fork River inundated by the runoff from a 24-hour, 100-year frequency storm is 6,515 acres. In addition, about 7,800 acres of Deep Fork River floodplain are subject to damage from the tributary runoff. Floodwater damage to this floodplain area from storm runoff has been evaluated by the Corps of Engineers.

There are approximately 75 landowners and operators of agricultural land of the floodplain of the eight tributaries. The average annual acres flooded on these creeks are 5,786.

The composite land use of the eight creek floodplains is generally: cropland, 51 percent with alfalfa and wheat being the major crops; pasture and range, 41 percent (including 6% forest); urban, 2 percent; and miscellaneous, 6 percent.

Extensive flood damage occurred to private and public properties in a section of the City of Chandler from storms in June and October of 1974. Flood damage to homes, other properties, and miscellaneous equipment due to the June 1974 storm was estimated by the Highway Department, Small

Business Administration, and local representatives to amount to \$125,000. Although no lives were lost during this storm, accidental drownings in the city could easily have occurred. Flood damage from the October 1974 storm was high but not equal to the June storm because people were now aware of the danger and made advance preparation. Road, bridge, crop, and land damage was extensive on other tributaries in the watershed as a result of the 1974 storms. A farm to market road, which is a mail and school bus route in the Spring Creek floodplain, was heavily damaged during these storms. The June storm was a 50-year frequency occurrence and the October storm would be expected to occur once every 10 years.

The eight evaluation units include the following named creeks: Bellcow, Eagle, Smith, Wildhorse, Captain, Spring, Pecan, and Kickapoo. Bellcow Creek runs through a section of the City of Chandler, and causes both urban and agricultural damage. The remaining tributaries run through agricultural areas (See project map). The average annual gross value of crop and pasture production per acre (current normalized prices) for the eight tributaries ranges from \$91 to \$138.

The average annual direct and indirect flood damages are estimated to be \$290,410. These damages are itemized as follows:

<u>Item</u>	<u>Damage</u>
Crop and Pasture	\$ 85,060
Other Agricultural	61,180
Nonagricultural	
Roads and bridges	39,580
Urban	6,600
Sediment	
Overbank deposition	43,740
Swamping	1,900
Reservoir (Lake Eufaula)	10,710
Erosion	
Floodplain scour	20,040
Indirect	21,600
Total	\$ 290,410

Erosion Damage

Sheet erosion on cultivated and formerly cultivated land in the upland portion of the watershed is the major source of sediment. Gully and roadside erosion is also severe and these areas are significant contributors of sediment from the uplands. There are about 384 critical sediment source areas in the watershed which cover about 2,138 acres.

Flooding has caused erosion damage on 469 acres of floodplain. Measured by reduced productivity, damage ranges from 20 to 30 percent.

The gross erosion rate in the watershed under present conditions is about 5.3 tons per acre per year. About 88,835 acres are losing a ton of soil or less per year. About 74,025 acres are losing from 1.0 to 5.0 tons per acre per year, and about 2,260 acres are losing from 5 to 15 tons per acre each year.

Average annual damages due to erosion in the watershed are estimated to be \$20,040.

Sediment Damage

About 2,149 acres in the floodplain have been damaged by sediment deposition. In terms of reduced productivity, a total of 842 acres have been damaged 20 percent; 86 acres have 25 percent damage; 1,221 acres have been damaged 35 to 40 percent. In addition to the normal reduction in productive capacity, a great many pecan trees have been damaged and many have died due to the depth of the sediment deposits.

Sediment has blocked the natural drains causing impoundment of water on a 24-acre area on Bellcow Creek and a 79-acre area on Captain Creek. These areas have been damaged approximately 70 to 90 percent by swamping.

One of the major problems caused by sediment has been the filling or blocking of stream channels. Much of the floodplain portion of the stream channels has gradually filled with accumulated sediment so that the channel capacities have been greatly reduced. Runoff from a rain which would have been contained within the stream channels a few years ago, now results in flooding. The flooding causes increased sediment deposition and the cycle repeats itself. Other sediment damage occurs when the sediment covers growing crops, wildlife food supplies, dens, nesting areas, and escape cover. Many young animals and birds are destroyed and those that remain are weakened and more subject to disease than their upland neighbors.

Average annual damages from sediment deposition total \$56,350, with \$43,740 attributable to overbank deposition and \$10,710 from sediment delivery to Eufaula Reservoir and \$1,900 due to swamping. About 53 acre-feet of sediment from the watershed is deposited in Eufaula Reservoir annually.

Water quality, though satisfactory from the standpoint of dissolved solids, is adversely affected by sediment. Geologic formations in the watershed include shales with a colloidal clay content. The colloidal materials eroded from soils formed on this parent material and from the shales themselves are carried into the streams where they remain in suspension almost indefinitely. The problem has multiplied many-fold

with agricultural development. These practices not only increased suspended sediment but increased the bedload of sand which has resulted in damage to agricultural land when deposited overbank during flood flows. After sediment is deposited on vegetation, veterinarians instruct the cattlemen to keep livestock from the area to prevent diseases caused by the consumption of these sediment polluted forages.

The average annual sediment yield at the mouth of the watershed, combining bedload and suspended load, is estimated to be about 171 acre-feet or about 269,154 tons. It is estimated that about 80 percent of this total is in suspension, resulting in a sediment concentration of 1,665 ppm. The pollution of streams in the watershed by this suspended sediment detracts from potential practical uses of the water and related aesthetic values of the natural environment.

Drainage Problems

Due to inadequate outlets for some of the tributaries, drainage problems are considerable in some parts of the watershed. However, until the level of the Deep Fork River is lowered, there is no practical solution to this problem.

Irrigation Problems

There are presently no irrigated areas in the watershed. However, nearly all of the bottomland and most of the uplands have soils which would benefit from supplemental irrigation.

The two major aquifers in the region, the Garber Sandstone and the Vamoosa Formation, yield relatively large quantities of water. In areas of development around Oklahoma City, the water is of good quality and suitable for most uses. Many of the tributaries of Deep Fork contain good quality water with only small concentrations of dissolved minerals. Impoundments of streamflow may provide a water of better quality than that during low flow because of mixing of high-flow water of good quality with low flow water of poor quality (2).

Most of the crops grown in the watershed would benefit from supplemental irrigation during the short, severe, dry periods which often occur in this area, and during the prolonged drouth periods which are not infrequent.

Municipal and Industrial Water Problems

There is an estimated industrial water need in the watershed of 500,000 gallons per day but only 300,000 gallons are presently available. At

the present time the municipal water supply in the watershed is adequate. However, by the year 2005 based on the current trends, the City of Chandler estimated that their present water supply will only provide 43 percent of the water required. There are presently 850 water connections in the City. It is anticipated that this number will grow to 1,200 within the next few years.

The Town of Wellston also indicated an interest in adding storage for a municipal water supply. A study was made to include municipal storage as a project purpose, but the town decided to improve and add to their present well system to increase their water supply. Officials from the Cities of Chandler, Davenport, and several county organizations have formed a trust authority to work with various county wide problems. This group has just been formed and their immediate concern is solid waste disposal. However, they have expressed an interest in water problems within the county and they may become involved in this project in the future.

Recreation Problems

There is a need for waterbased recreation in the area since few of the existing water supplies in the watershed provide recreation. There is one developed recreation area near Warwick which has been organized around a 35-acre lake. There are several recreation areas within a 50-mile radius of the watershed. However, there are over 26,000 people within a 25-mile radius and over 509,000 people within a 50-mile radius. Consequently, additional waterbased recreation is needed in the area.

Fish and Wildlife Problems

The stream fishery resources in the immediate project area, excluding the Deep Fork River, are insignificant. There are, however, a few isolated pools in the tributaries which contain several species of sunfish (19).

The land use trend in the watershed has been a reduction of cropland, rangeland, and forested range, and an increase in tame pasture and urban and miscellaneous areas. The reduction of the wooded areas has been gradual. However, the loss of these areas has reduced the total woodland wildlife habitat in the watershed and this trend is expected to continue. The reduction in the native grass areas and the increased suburban buildup has also reduced the total amount of open land wildlife habitat in the watershed. Some species, such as turkey, do not tolerate man's activities very well and their numbers are gradually decreasing as urbanization continues.

Flooding and sediment deposition have a detrimental influence on floodplain wildlife. Since floods often occur during the spring, many newborn of the ground nesting species are drowned and nests and dens are covered with sediment. Food supplies are also covered with sediment and the total wildlife population in the floodplain is usually reduced following a major flood.

No known rare or endangered species frequent the watershed. The Peregrine falcon and the Southern bald eagle may be infrequent transients in the area.

Water Quality Problems

The major pollutant in watershed streams is sediment from the uplands. Records from a water quality station in an adjoining watershed (Dry Creek at Kendrick), with an average daily discharge of 74 cfs taken on July 1, 1971, showed a sediment concentration of 4,160 ppm or a rate of 696 tons per day. Two similar samples taken on March 10, 1973, with a maximum discharge of 3,490 cfs and a daily discharge of 842 cfs had calculated sediment discharge rates of 6,090 and 3,060 tons per day, respectively. Although sediment loads may adversely affect the visual quality of the water, it apparently has not affected the chemical quality. Based on soils and land use information, the water quality in the Kickapoo Nations Watershed will be similar to that observed in Dry Creek.

Economic and Social Problems

In 1974, 52 percent of the total farms in Lincoln County and 51 percent of those in Oklahoma County had sales of less than \$2,500 (18). Lincoln County had 70 percent of the total farms with sales less than \$5,000 and Oklahoma County had 65 percent of its farms in this category. In 1969, another 32 percent of the farms in Lincoln County and 35 percent in Oklahoma County were classed as "part time" farms. Such farms have an operator under 65 who markets \$50 to \$2,499 and yet works off of the farm 100 days or more (17).

Farm operators and other family members comprise 85.7 percent of the total farm labor force in 1970. All workers per farm, including both family and hired, ranged from a high of 1.73 in June to a low of 1.13 in December. The economy of the watershed is based on livestock production. In 1974, about 53 percent of the gross farm income from Oklahoma County and 81 percent of the gross farm income from Lincoln County was from livestock, primarily beef cattle (18). In 1969, another 32 percent of the income was from dairy products (6). Most of the cropland is used for the production of feed crops to support the livestock industry.

RELATIONSHIP TO LAND USE PLANS, POLICIES, AND CONTROLS

The proposed action does not conflict with the objectives or specific terms of approved or proposed federal, state, or local land use policies, plans, or controls.

ENVIRONMENTAL IMPACT

CONSERVATION LAND TREATMENT

Land treatment measures will be installed on about 45,728 acres which have not been previously treated. About 81,730 acres in the watershed are presently adequately treated.

The installation of land treatment measures proposed in this project will reduce flooding caused by a 100-year frequency storm from the present 6,515 acres to 6,189 acres. A completed land treatment program will reduce the acres flooded by a 2-year flood from 3,452 to 3,281 acres.

Changes in future land use from a "without action" condition to those expected as a result of land treatment are:

1. A 546 acre increase in cropland.
2. A 719 acre increase in tame pasture.
3. A 1,210 acre decrease in native range.
4. A 55 acre decrease in forest.

Installation of all of the land treatment measures will decrease the water runoff from the uplands about 5 percent. The land treatment measures include those to be installed on critical sediment source areas. These measures will include mechanical and vegetative practices oriented toward controlling the critical point sources of sediment on about 2,045 acres. Soil loss from upland in the watershed will be reduced by land treatment measures from an average of 5.0 tons per acre to 4.3 tons per acre annually, a decrease of 14 percent.

The acceleration of the installation of the land treatment measures will provide a short term stimulus to the local economy. The rapid installation of these measures will result in some of the unemployed or underemployed individuals in the watershed finding employment.

The overall appearance of the watershed will be improved by the installation of the land treatment measures. Unsightly eroded areas will be vegetated and the large sediment fans in the floodplain areas will be greatly reduced or eliminated.

Although land treatment measures, on the whole, are not designed to improve wildlife habitat, they do have a beneficial effect. Although these effects are minor when each specific measure is considered, on the whole they are highly beneficial and would significantly affect the wildlife habitat in an area. Such practices as cover cropping, crop residue use, stubble mulching, and proper range use, all provide additional sources of food and cover for many species of wildlife. These sources would not be present if the land treatment measures were not being carried out and the habitat would be of a lower quality.

In addition to the 65 acres of tree planting, an additional 1,980 acres of critical areas are scheduled for treatment. Nearly all of these areas will eventually be established in permanent vegetation. They will provide what is essentially new wildlife habitat since they are presently practically devoid of vegetation. Elimination of these areas will also eliminate a major source of sediment which causes considerable damage to wildlife in the floodplain. Many of these critical areas will be fenced to exclude livestock, thereby increasing their value.

STRUCTURAL MEASURES

The construction of the floodwater retarding structures will result in the conversion of about 564 acres of cropland, 1,011 acres of grassland, 91 acres of bottomland forest, and 32 acres of upland forest to water surface which will gradually decrease over a 50-year period as it is replaced by sediment. An additional 1,987 acres will be inundated intermittently in the detention pools following periods of heavy rainfall. This area is presently occupied by 185 acres of cropland,

1,640 acres of grassland, 22 acres of bottomland forest, and 140 acres of upland forest. The following table shows the present land use in site areas:

Site No.	Acres		Sediment Pool (acres)				Detention Pool (acres) ^{2/}			
	Sed.	Det ^{2/}	Crop-land	Grass-land	Bottom:Forest	Upland:Forest	:Crop-land	:Grass-land	:Bottom:Forest	:Upland:Forest
1-M	1070 ^{1/}	465	363	667	40		19	402	14	30
2	27	79	5	19	1	2	15	55		9
3	19	50	2	15	1	1		47		3
4	34	70		32	1	1	30	25		15
5	33	62	14	17	1	1		60		2
6	10	28	6	3		1		24		4
7	21	34	15	5		1		29		5
8	36	89	21	12	1	2		75		14
9	92	224	18	64	10			196	3	25
10	28	61	23	5			20	39		2
11	48	121	26		10	12	31	85	5	
12	94	270	60	11	20	3	70	183		17
13	44	116		40	2	2		116		
14	17	32		15	1	1		28		4
15	29	69		27		2		66		3
16	14	26		13	1			24		2
17	18	42	4	13	1			42		
18	30	58	7	21	1	1		57		1
19	15	38		14	1			37		1
20	19	53		18		1		50		3
Totals	1698	1987	564	1011	91	32	185	1640	22	140

It is expected that the cropland in the detention pools will eventually be converted to tame pasture because of intermittent inundation. About 103 acres in dams and spillways will be planted to adapted vegetation suited for erosion control, controlled grazing use, and for wildlife food and cover where practical.

Land use changes expected to occur as a result of reductions in flooding and associated damages following project installation include an increase of about 1,200 acres in cropland; an increase of about 1,200 acres in tame pasture, a decrease of about 3,500 acres in rangeland; a decrease of about 1,100 acres in forest; and an increase of about 2,180 acres in urban and miscellaneous areas.

^{1/} Including M&I water supply.

^{2/} Includes 103 acres in dams and spillways.

About 2,180 acres of land will be converted from agricultural to non-agricultural use. The following table shows the present land use and the percent of the total watershed. It also shows the estimated projected land use without the project, with the project, and the percent change from the present.

Land Use	Present (acres)	Percent of Area	Without Project (acres)	Percent Change from Present	With Project (acres)	Percent Change from Present
Cropland	17,526	11.0	16,454	-1.0	17,650	0
Tame Pasture	41,330	25.0	42,781	+0.9	44,000	+1.6
Range	57,536	35.0	56,460	-1.0	52,950	-3.0
Forest	46,745	28.0	44,805	-1.0	43,719	-2.0
Urban	1,503	0.9	4,000	+1.5	4,500	+1.8
Miscellaneous	660	0.1	800	0	2,481	+1.4
Total	165,300	100.0	165,300		165,300	

The reduction in annual floodwater damages will enhance usage of the floodplain lands, increase crop yields, and improve the quality of pastures. Floodplain enhancement may encourage an increase in the usage of fertilizers and pesticides. Recent technological and legislative developments regarding pesticides have reduced the hazard potential through greater use of "short life" chemicals.

At least one research agency has indicated that there is increasing evidence that eroded sediments from agricultural lands play a major role in the transport of some agricultural chemicals to streams and surface water impoundments (1). In the proceedings of the workshop on water quality and land use activities held at Guelph, Ontario, in September 1973, Dr. R. F. Holt (as well as most other experts in fertilizer and pesticide transport) concluded that "the bulk of the chemicals transported by water off agricultural land is attached to or is an integral part of the sediment." Those activities which reduce sediment production will also reduce fertilizer and pesticide movement. The planned project will have a positive effect in limiting future fertilizer and pesticide damage to downstream areas by reducing the sediment leaving the watershed by about 57 percent.

The possibility of eutrophication of the stream system as the result of enrichment from additions of nitrogen and phosphorus fertilizers has been considered. It has been pointed out that enormous growth of plants in streams and lakes does not occur if the nitrate as N is kept below 0.3 ppm and the total nitrogen as N is below 0.6 ppm (10).

Not only must nitrogen and phosphorus be present in sufficient quantities and in the proper chemical forms, they must also be present in the proper proportion. A common nitrogen to phosphorus ratio of approximately 30:1 is required to promote an algal bloom. It has been reported that plankton were 13 times more abundant in clear water, and 1.5 times more abundant in moderately turbid waters than in muddy Oklahoma ponds (8). Algae growth is not a problem on the Kickapoo Nations Watershed at the present time.

In order to compare the proposed project with a stream system having historical data on water quality and flood control programs, the Washita River study was used. Water quality data from May, 1944, until the present are available at the Durwood gage near the lower end of the Washita. An extensive system of floodwater retarding structures has been installed and resultant changes in land use and pesticide and fertilization usage have occurred since 1944. The first floodwater retarding structures were built on the Washita in 1948. By 1957, 171 floodwater retarding structures (primarily in the upper reach above Clinton, Oklahoma) controlling approximately 7.0 percent of the area above the Durwood gage had been constructed. The period from May 1944 through 1957 essentially represented the pre-project period when there was a limited number of structures. Fertilization was not a common practice prior to 1957. The Bureau of Reclamation's Foss (1961) and Fort Cobb (1959) Reservoirs, together with the presently constructed 983 watershed reservoirs, now control 51 percent of the drainage area above the Durwood gage.

An examination of the historical trends of discharge versus nitrate (NO_3) concentrations for periods before and after 1957 discloses the fact that the trend of nitrate concentration was downward during the period when project measures had greatly reduced the overbank flows.

Chemical analyses of ortho-phosphate (PO_4) were not initiated until 1967 so a before and after comparison is not possible. However, measurements were made during 1967 and 1968 water years.

The nitrate and phosphate concentrations measured were sufficient and in proper ratio to have caused algal blooms in clear water; however, significant symptoms of eutrophication in the Washita River or Lake Texoma below have not been noted during this period.

Sediment production in the Kickapoo Nations Watershed will be reduced from 171 acre-feet under present conditions to 74 acre-feet with the installation of the proposed project.

With the installation of structural measures, the area flooded from a 100-year flood on all tributaries within the Kickapoo Nations Watershed will be reduced to 5,053 acres as compared to 6,189 acres flooded under future conditions with land treatment only. A 2-year frequency storm would be reduced from 3,281 acres with future land treatment only to 1,607 acres with the installation of the complete project. A farm to market road in the Spring Creek floodplain, which is a school bus and mail route, will be protected from all except the most severe storms.

The average annual acres inundated on all tributaries will be reduced from 5,786 to 2,502 acres (3,284 acres), a reduction of 57 percent.

The peak discharge for a 100-year frequency storm on Captain Creek under future conditions with land treatment at reference valley cross section 11-5 (Figure 2) is 18,217 c.f.s. With the installation of this project, the peak discharge on Captain Creek will be reduced to 6,747 c.f.s. This is typical of the reductions which will occur throughout the floodplain area when the project is installed.

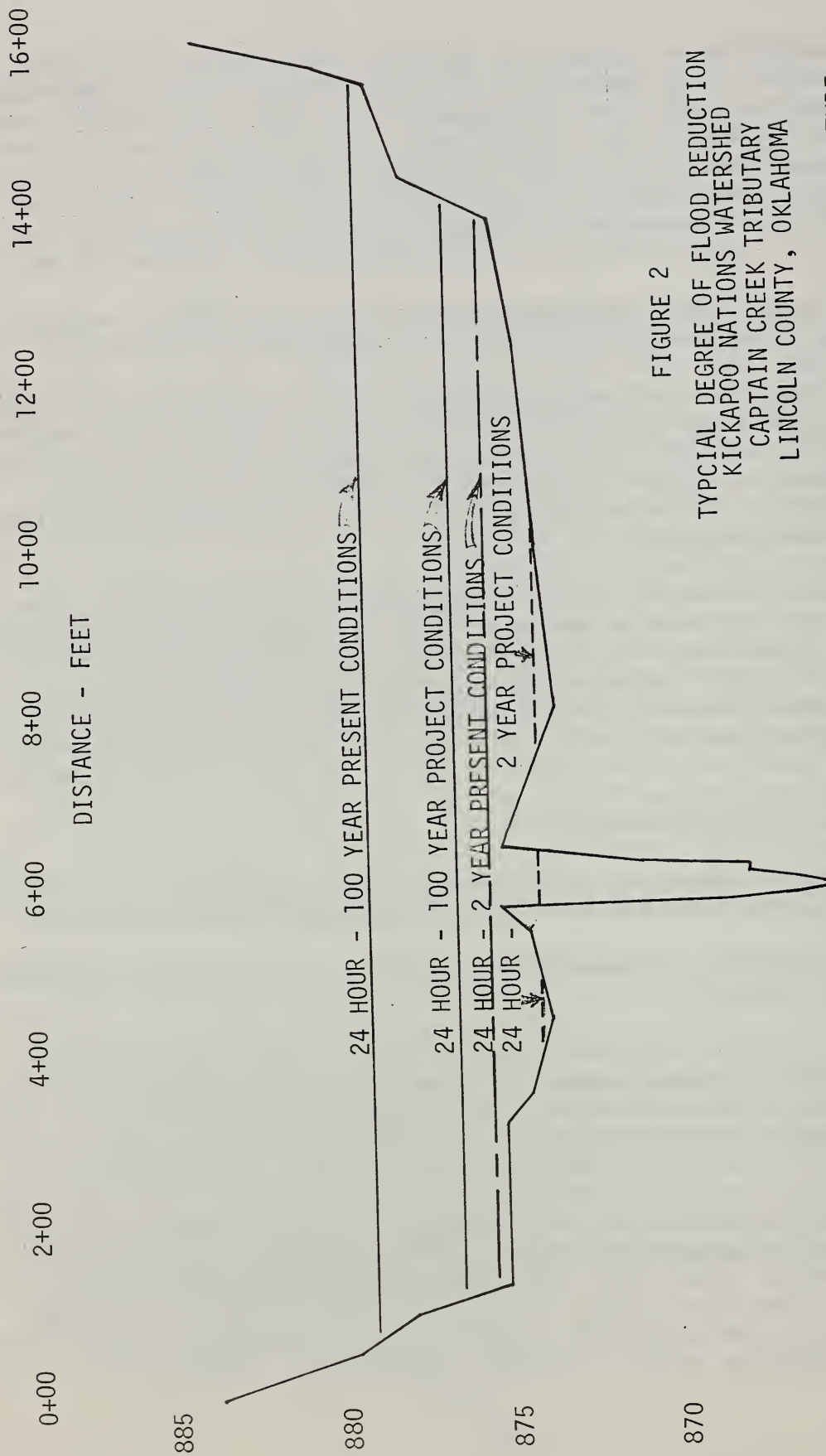
There will be a net average annual evaporation loss of about 24 inches from the surface of lakes in the watershed. Assuming that the sediment pools of the floodwater retarding structures are always full of water, the 3,418 acre-feet of annual evaporation loss would represent a 6.2 percent reduction in water yield from the project area. Disregarding the multipurpose reservoir, which will have initial 100-year sediment storage, the reduction in watershed yield will decrease from 6.2 percent immediately after construction to zero at the end of 50 years as the sediment pools fill with sediment.

Since 1970, 26 stream gaging stations in Oklahoma have been monitored for pesticides in a cooperative effort by state and federal agencies.

The results in testing is summarized annually by the Oklahoma Department of Agriculture (11).

One of the 26 stations being monitored is on the Sugar Creek Watershed in south central Oklahoma. Sugar Creek has a watershed protection project similar to the one proposed on Kickapoo Nations Watershed. The first floodwater retarding structure was completed on Sugar Creek in 1963 and the final structure was completed in 1973. The floodplain on Sugar Creek is primarily in cropland and the intensity of fertilizer and pesticide application has increased significantly since the first floodwater retarding structure was built in 1963. Three or four pesticide monitoring samples a year were taken from 1970 to 1972 and monthly samples were taken from October 1972 through October 1973. Pesticide analysis was made for total DDT, dieldrin, aldrin, gamma BHC, heptachlor, chlordane, toxaphene, erdrin, epoxide, methoxychlor, lindane, and

TYPICAL CROSS SECTION
VALLEY SECTION 11-5



ELEVATION - M.S.L.

FIGURE 2

TYPICAL DEGREE OF FLOOD REDUCTION
KICKAPOO NATIONS WATERSHED
CAPTAIN CREEK TRIBUTARY
LINCOLN COUNTY, OKLAHOMA

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
STILLWATER, OKLAHOMA

JANUARY 1977

arochlor 1260. In February and May 1971 values of 0.80 and 0.96 parts per billion chlordane respectively were detected. The May 1972 samples recovered 0.1 part per billion total DDT while the July 1973 sample showed the presence of 0.63 parts per billion of arochlor 1260. Pesticides were detected in only four samples during this period and were present in extremely minute quantities. No other traces of pesticides were found in almost four years of systematic streamflow analysis for 12 of the common index pesticides. Similar results are expected from the Kickapoo Nations Watershed.

When the planned project has been completed, quality of water below the structures will be improved by a reduction of sediment now present in the streamflows. This reduction will result from proper land treatment on agricultural land, accelerated land treatment of critical sediment source areas, and the trapping of sediment by floodwater retarding structures.

The impact of the project on the archeological resources of the watershed will be insignificant. However, the survey due to the project has resulted in the discovery of one significant historical site and 16 minor archeological sites which probably would not have been reported otherwise. The historical site was nominated for, and subsequently included in, the National Register of Historic Places. None of the other historical and archeological sites discovered by the archeological survey were determined to qualify for nomination to the National Register of Historic Places. 1/

Air quality in the watershed will be essentially unaffected by the planned project. There will be a temporary increase in noise levels and pollution of air from dust and exhaust emissions which are inherent in the construction process. However, since all of the sites are in a rural area, with normally brisk winds prevailing much of the year, the minor effects of construction activities will be localized and largely undetectable to the local residents.

The flow regime of the streams will be significantly altered. The peak flows on the streams will be greatly reduced, and the duration of flows will be prolonged due to the controlled release of floodwater from the structures. This will reduce flooding and stabilize streamflow for prolonged periods. Reduced flooding will enable school buses and rural mail carriers to better keep their schedules and reduce the risks to travelers.

Some of the sites are located on geologic formations which may allow local groundwater recharge. These formations contain numerous lenses of impervious shale which restricts lateral movement of groundwater and therefore limits recharge effects. On the sites where some recharge occurs, the water level below the sites will rise until the streams

1/ The Archeological Survey Report is available for review at the SCS, State Office, Farm and Brumley Road, Stillwater, Oklahoma.

become nearly permanent for a short distance below the sites. This distance would vary depending on the exact location of the shale lenses and the permeability of the streambed as well as the amount of water entering the streambed from other tributaries.

Sediment production will undergo a slight temporary increase during the construction process due to earth-moving activities and the accompanying removal of vegetative cover. The structures and other disturbed areas will be vegetated for erosion control as soon as construction has been completed.

The presence of the 20 small lakes scattered throughout the watershed will provide a pleasing note to the countryside, based on the appearance of sites which have already been installed in nearby watersheds. This will result in increasing the urban development in a rural setting which will lower esthetic values, increase sediment, and increase pressures on wildlife species due to reduced agricultural land use and more disturbance in the whole area.

The construction of the multipurpose site will provide a needed source of municipal water for the City of Chandler. The city's present water supply comes from a surface impoundment which will not be adequate for future needs and they have been unsuccessful in developing water wells as an alternate source of supply. This project will allow the city to continue to expand and grow with the knowledge that they will have an adequate water supply for the foreseeable future.

The development of the recreational facilities will provide needed recreational opportunities. This facility will attract visitors from nearby Oklahoma City who will bring new money into the watershed area. This will improve the overall social well-being of local residents and stimulate the local economy.

The destruction of about 123 acres of forest in the sediment pool areas of the structures will result in a decrease in woodland wildlife habitat which will not be replaced. In addition to the timbered areas, 564 acres of cropland and 1,011 acres of grassland will also be converted to water. However, other project induced land use changes will result in few, if any, adverse impacts on openland wildlife. The addition of 1,698 acres of water will result in an increase of habitat for migratory waterfowl, shore birds, and other water oriented species of wildlife such as raccoon, muskrat, mink, and beaver. The addition of these scattered lakes in the upland will also increase the diversity of wildlife species in the upland since presently there are few lakes in the upland area. These new lakes also have the potential to provide a new high quality fishery resource in the watershed if they are properly stocked and managed.

The loss of 123 acres of woodland habitat caused by construction of the floodwater retarding structures and the 55-acre decrease expected due to land use changes may result in a slight decrease in woodland wildlife species in the watershed. The addition of 65 acres of tree planting planned in the treatment of the critical sediment source areas will create desirable habitat where little or none now exists.

These plantings will be scattered throughout the upland area of the watershed in small areas, and consequently will aid in distribution of woodland wildlife species.

The loss of the upland habitat will initially result in the migration of woodland wildlife species into adjacent areas. If the adjacent areas are already totally stocked with wildlife species, the displaced animals will eventually perish due to a lack of habitat. However, if the area is understocked, at least some and possibly all of the displaced animals will be able to relocate satisfactorily. In either event, the presence of the dependable water supply in the upland area will benefit the woodland wildlife species remaining in the site vicinity.

Wildlife populations will become more stable in the floodplain due to fewer drownings of young and destruction of den areas by floodwater and sediment. Wildlife food supplies will also be improved in the floodplain due to reduced sediment deposition and flooding. Water oriented species including migratory waterfowl are expected to increase due to the presence of 1,698 acres of new habitat in 20 small lakes distributed throughout the watershed.

The decrease in sediment will have a beneficial effect on the stream ecosystem below the structures. The species diversity of benthic organisms will increase through 4th or 5th order streams; the stream environment will improve for bottom dwelling organisms; and low order streams (the upper reaches of the tributaries) will become colonized with macroinvertebrates. This increase in the diversity and the total numbers of organisms at the lower end of the food chain will result in a major improvement in the stream's ecosystem.

ECONOMIC AND SOCIAL

The planned project will have a significant beneficial effect on the economy of the area. The estimated average annual monetary floodwater, sediment, erosion, and indirect damages (Table 5) will be reduced from \$290,410 to \$76,990 by the proposed structural measures. This is a reduction of 73 percent.

The source and amount of the average annual damage reduction benefits are as follows:

Crop and Pasture	\$ 50,090
Other Agricultural	57,640
Nonagricultural	
Road and bridges	35,520
Urban (Chandler)	6,300
Sediment	
Overbank deposition	28,540
Swamping	960
Reservoir (Eufaula)	5,070
Erosion	14,440
Indirect	<u>14,860</u>
TOTAL	\$213,420

The elimination of frequent flooding will encourage farm operators to restore floodplain land to former production levels and to intensify production practices to produce at the most efficient level possible. The benefits due to changed land use and intensified land use are estimated to be \$56,490 and \$72,760, respectively.

The Corps of Engineers in their evaluation studies of Arcadia Reservoir made estimates of flood damage reduction benefits to the Deep Fork River floodplain. These studies considered existing and proposed Public Law 566 programs that are actively being developed on tributary watersheds in the middle and lower reaches of the Deep Fork River Basin.

Floodwater damage reduction benefits accruing to the Deep Fork River floodplain as a result of project installation on the eight creek tributaries evaluated in the watershed are estimated to be \$88,410. These benefits are included in crop and pasture, other agricultural, and nonagricultural benefits in Table 5, and damage reduction benefits in Table 6.

The watershed is located in an area designated by the Secretary of Agriculture as eligible for rural area development under the Economic Development Act of 1965. For this reason employment benefits based on project construction, operation, and maintenance costs were evaluated. These benefits have an estimated annual value of \$40,640.

The average annual domestic and industrial water supply benefits accruing from multipurpose site 1-M are estimated to be \$338,000. These municipal water supply benefits were determined by the consulting engineers for the City of Chandler on the basis of projected needs and cost of raw water.

The provisions for recreational facilities and added water storage in the multipurpose structure will provide average annual recreation benefits of \$139,500. The recreation facilities will generate an estimated 62,000 recreation days each year.

It is estimated that \$923,650 in average annual benefits will accrue to the regional or primary area of influence, effected as a result of the watershed project.

The development of the municipal water supply for the City of Chandler will allow this city to continue to grow and develop since the supply will be adequate for a population of about 8,500 people which the city is projected to have in the year 2005.

External economy benefits accruing as a result of increases in output of final consumer goods and intermediate producer goods over and above the primary benefits will amount of \$62,840.

Twenty-nine permanent semi-skilled jobs and 83 man-years of employment during the construction phase will be created by the project. Reduced flood damages to crops, pastures, and improvements will directly benefit 75 owners and operators of floodplain land. The average annual reduction in flood damages will amount to \$213,420. About 75,000 people will benefit from the project.

The total primary benefits occurring as a result of flood reduction, municipal water supply, and recreational water storage with the accompanying facilities amount to \$860,810.

The stabilized farm income plus the improved economic conditions of many of the low and medium income families will generate an economic stimulus which will result in local merchants improving goods and services throughout the area. The reduction of flooding in both agricultural

and urban areas will reduce the worry and tension of local residents, and the 100-year flood protection in the City of Chandler will significantly reduce the possibility of the loss of life from accidental drownings. The 20 small lakes scattered throughout the watershed will add a pleasing note to the appearance of the local countryside. The stabilization of the stream base flows will also improve the aesthetics of the area, as will the elimination of the unsightly sediment fans which are presently common in the floodplain. Although the stream flows will be stabilized, the total water flow from the watershed area will be decreased by 6.2 percent each year, primarily due to evaporation from the structures. This amount will decrease gradually as the pools fill with sediment until, when all of the sediment pools are filled, no evaporation will take place and the reduction in flow will no longer occur.

FAVORABLE ENVIRONMENTAL IMPACTS

1. Reduce runoff, erosion, and flooding, with associated agricultural and non-agricultural damages, directly benefitting 75 landowners and operators and about 75,000 other persons.
2. Increase crop yields and improve the quality of pasture grasses.
3. Stabilize family farms and increase net returns of low income operators.
4. Create employment opportunities through operation and maintenance of project measures.
5. Enable school busses and rural mail carriers to better keep their schedules and reduce the risks to travelers.
6. Reduce the destruction of ground nesting birds and animals in the floodplain and thus sustain a more stable, permanent game population.
7. Provide 1,698 acres of water for habitat for water oriented species, including migratory waterfowl. This habitat will last until the pools finally fill with sediment, an estimated 50 years.
8. Stabilize stream base flows.
9. Reduce the total sediment yield from the watershed.
10. Improve water quality below the structures by reducing sediment concentration.
11. Improve the appearance of the countryside by the addition of water surface area and the elimination of many severely eroding areas.
12. Provide a new recreational facility in the watershed area.
13. Provide opportunities for employment of local labor presently unemployed or underemployed as well as increasing business activity and improving economic conditions in the region and state as a whole.
14. Stabilize most of the 2,138 acres of critical sediment source areas in the watershed.
15. Contribute to historical and archeological knowledge through the discovery of one significant historical site and 16 archeological sites which would probably not have been reported otherwise.
16. Provide a needed source of municipal water for the City of Chandler.
17. Improve the physical environment of the stream so that the diversity of species of benthic macroinvertebrates will increase and provide an increased food source for water oriented wildlife species.

ADVERSE ENVIRONMENTAL IMPACTS

The project will:

1. Reduce land available for agricultural production by 1,698 acres for at least 50 years.
2. Occasionally interrupt use of land in the retarding pool areas which are subject to intermittent inundation.
3. Restrict land use on areas needed for dams, spillways, and appurtenances.
4. Out of the present 47,000 acres of woodland wildlife habitat in the watershed (1,957 acres of which are bottomland hardwoods), 123 acres will be destroyed (91 acres of which will be bottomland hardwoods) due to timber clearing in the site areas.
5. Temporarily disrupt wildlife habitat during construction of dams.
6. Cause localized short-term increases in erosion and turbidity during construction of dams.
7. Result in short-term air and noise pollution caused by operation of heavy equipment during construction.
8. Increase the urban development in a rural setting which will lower esthetic values, increase sediment, and increase pressures on wildlife species due to reduced agricultural land use and more disturbance in the whole area.
9. Decrease water flow from the watershed by 6.2 percent per year until the sediment pools fill with sediment at which time this impact will be eliminated.

ALTERNATIVES

Alternatives studied during the formulation of the selected plan were of two basic types: those which would satisfy component needs identified by concerned publics for national economic development (NED) and environmental quality (EQ); and those which would further reduce or eliminate adverse impacts to the environment resulting from the selected plan.

The identified component needs for NED and EQ are described in the Project Purposes and Goals Section and the adverse impacts resulting from installation of the selected plan are described in the preceding section.

Most of the component needs, including both NED and EQ objectives, could be grouped within two groups because the plan elements needed to satisfy each group are the same or the component need added would not compromise the objective of that group. Some EQ component needs are satisfied by the elements of the NED plan, but some plan elements selected to satisfy the NED component needs result in adverse effects upon the EQ objective; therefore, an alternative plan to satisfy the EQ objective component needs was formulated.

Of the alternatives studied, only numbers 2, 4, and 5 were considered viable. Viable alternatives are those plans which can be implemented with assistance under existing USDA authorities, and for which a public body has expressed a capability to implement. See Appendix B for displays.

Alternatives 1, 3, 6, and 7 were evaluated in response to specific concerns and to determine adverse impacts of the selected plan that might be avoided by adoption of another course of action.

The alternatives studied during plan formulation were as follows:

Alternative 1 - Accelerated land treatment alone. Application of land treatment measures alone would exert only minor effects on damages resulting from flooding. Soil loss from the uplands would be reduced from 5.0 tons per acre to 4.3 tons per acre per year. This is a reduction of 14 percent. Flooding from a 100-year frequency storm would be reduced about 344 acres by the land treatment measures, a reduction of about 5 percent. There will be about 5,786 acres flooded on the average each year under this alternative. The installation of the land treatment measures will have a beneficial effect on the wildlife in the watershed, particularly in the uplands. Use of legumes in rotations, crop residue management, and other practices will result in an increase in food and cover for numerous species of wildlife. These increases are small for most individual farms and ranches; however, when they are considered for the entire watershed, they are highly beneficial.

Although the effects of this alternative would be beneficial, the improvements would be relatively minor. As well as avoiding all of the adverse effects from structural measures, the favorable effects for the structures in the selected plan will be foregone. Installation of this alternative would reduce the average annual damages by about 4.8 percent. Average annual damages under this alternative would amount to about \$290,410. However, conditions in the watershed will not remain static. The annual damages caused by flooding will accelerate if flooding is not reduced. The realization of \$213,420 in average annual benefits will be foregone. The cost of this alternative is estimated to be \$4,569,970.

The adverse impacts of the selected plan which could be avoided if this alternative were installed are:

1. 1,698 acres of land involved in sediment pools would not be removed from agricultural production.
2. 1,987 acres involved in detention pools would not be restricted in use due to intermittent inundation.
3. The areas involved in dams, spillways, and appurtenances would not be restricted.
4. About 123 acres of forestland wildlife habitat would not be eliminated.
5. Water flow from the watershed would not be reduced by 6.2 percent.
6. The short-term disturbances caused by construction activities involving the floodwater retarding structures would be avoided.

Alternative 2 - the plan which satisfies the NED objectives, contains the same land treatment as alternative 1, 17 floodwater retarding structures, one multipurpose flood prevention-municipal water-recreation structure, and recreation facilities. This alternative would control 39.6 percent of the total drainage area. The area flooded by a 100-year, 24-hour frequency storm will cover 5,072 acres. There will be 2,538 acres flooded, on the average, each year under this alternative. The sediment pool areas of the 18 structures will inundate 1,671 acres while the detention pool areas will involve another 1,927 acres. Average annual benefits for this alternative will amount to \$855,690. Under this plan, a farm-to-market road in the Spring Creek floodplain will continue to be flooded and is expected to be damaged each year. This road is both a school bus and a mail route, and traffic will have to be re-routed during floods and until the damage is repaired.

This alternative will reduce sediment to Eufaula Reservoir by 68.9 acre-feet per year. It will reduce sediment damage to the floodplain by 1,108 acres annually and reduce erosion damage by 70.9 percent.

The entire stream ecosystem will be benefitted by the 18 structures, and 1,671 acres of new water habitat will replace a like amount of forest and openland wildlife habitat.

Average annual flood damages will be reduced about \$211,090 or about 72.7 percent. The total cost of this project is estimated to be \$10,409,491.

The adverse impacts of the selected plan which could be avoided if this alternative were installed are:

1. 138 acres involved in sediment pools would not be removed from agricultural production.
2. 386 acres involved in detention pools would not be restricted in use due to intermittent inundation.
3. The area involved in dams and spillways of two structures would not be restricted.
4. About 11 acres of forestland wildlife habitat would not be eliminated.
5. Water flow from the watershed would not be reduced by 0.3 percent.

Alternative 3 - consists of accelerated land treatment and channel work. The land treatment portion of this alternative would be the same as alternative 1. The channel work portion of this alternative would not be able to function properly due to inadequate outlets into the Deep Fork River. Adequate outlets would require channel work on the river to function properly, and the SCS does not have authority for this type of work. Consequently, this alternative was not evaluated in detail. At the present time, it appears that the monetary costs of this alternative would be exceptionally high. In addition, a new set of adverse impacts associated with channel work would be introduced.

Alternative 4 - the selected plan consists of accelerated land treatment, 19 single-purpose floodwater retarding structures, and the same multipurpose structure with associated recreational facilities as is found in alternative 2. This alternative is discussed in detail in the plan and EIS. In brief, this alternative will control 40.5 percent of the total drainage area. After the project is installed, the area flooded by a 100-year 24-hour frequency storm will cover 5,053 acres. On the average, 2,502 acres each year will be flooded. The sediment pool areas of the 20 structures will inundate 1,698 acres while the detention pool areas will involve another 1,987 acres. Average annual benefits for this alternate will amount to \$860,810. Under this plan, the farm-to-market road discussed in alternate 2 will be protected. This alternate will reduce sediment to Eufaula Reservoir by 71.5 acre-feet per year. It will reduce sediment damage to the floodplain by 1,131 acres annually and reduce erosion damages to the floodplain by 72.7 percent.

The entire stream ecosystem will be benefitted by the 20 structure, and 1,698 acres of new water habitat will replace a like amount of forest and openland wildlife habitat. Average annual flood damages will be reduced about \$213,420 or about 73.5 percent. The total cost of this project is estimated to be \$11,755,370.

Alternative 5 - satisfies the objectives for EQ and consists of the same land treatment as the previous alternatives, 24 single-purpose flood-water retarding structures, the same multipurpose and recreation facilities as alternatives 2 and 4, purchase and development of a 200-400 acre natural area in the vicinity of the multipurpose site, and purchase and restoration of the Bill Tilghman house.

This alternative would control 43.2 percent of the total drainage area. After the project has been installed, the area flooded by a 100-year 24-hour frequency storm will cover 4,094 acres. On the average, 2,336 acres will be flooded each year. The sediment pool areas of the 25 structures will inundate 1,812 acres while the detention pool areas will involve another 2,233 acres. Average annual benefits for this alternate will amount to \$878,270. Under this plan, the farm-to-market road discussed in alternate 2 will be protected. This alternate will reduce sediment to Eufaula Reservoir by 75.6 acre-feet per year. It will reduce sediment damage to the floodplain by 1,189 acres annually and reduce erosion damage to the floodplain by 76.1 percent. The entire stream ecosystem will be benefitted by the 25 structures, and 1,812 acres of new water habitat will replace a like amount of forest and openland wildlife habitat. Average annual flood damages will be reduced about \$220,620 or 76 percent. The total costs of this project is estimated to be \$12,797,982. However, the sponsors did not have sufficient funds to provide the natural area or the historical reconstruction. No other individual or group could be located to provide a source of funds for this part of the project. No adverse impacts of the selected plan could be avoided if this plan were installed.

Alternate 6 - the non-structural alternate, consists of the same land treatment as the preceding alternatives, purchase of 6,515 acres of floodplain, conversion of 6,515 acres of floodplain from agricultural uses to permanent vegetation of benefit to wildlife. This alternative would have only minor effects on the watershed problems. The land treatment part of the plan would reduce upland erosion. Other problems would be essentially unaffected. The cost of this alternative is estimated to be \$8,119,470.

The adverse effects of the selected plan that might be avoided by the adoption of this alternative are:

1. 1,698 acres of land involved in sediment pools would not be removed from agricultural production.
2. 1,987 acres involved in detention pools would not be restricted in use due to intermittent inundation.

3. The areas involved in dams, spillway, and appurtenances would not be restricted.
4. About 123 acres of forestland wildlife habitat would not be eliminated.
5. Water flow from the watershed would not be reduced by 6.2 percent.
6. The short-term disturbances caused by construction activities involving the floodwater retarding structures would be avoided.

Alternative 7 - no project. For comparison purposes a "no project" alternative is always included in the plan. In this watershed, all adverse effects of the planned project would be avoided and all of the beneficial effects would be foregone under no project conditions. Many of the land treatment measures would eventually be established under going programs. However, since the land treatment under the on-going program would be installed over a much longer period, inflation will cause costs to be higher and benefits will accrue at a slower rate. Many of the critical sediment source areas would never be treated under this alternative. Many of these areas are so large that costs for individual landowners are too great to bear.

Valuable soil that is irreplaceable will be lost. These gully systems will continue to grow and their extension will endanger other installed land treatment measures. The visual impact of these raw, eroding, areas will detract from the overall appearance of the watershed and aesthetic values will be greatly reduced. Society as a whole will lose due to the loss of this irreplaceable resource.

Without action, the land use changes would be minor. Cropland would decrease by 1 percent, as would woodland and native grass. Tame pasture would increase 1 percent, and urban and miscellaneous areas would increase about 2.5 percent.

Damages to the floodplain for flooding, erosion, and sediment deposition would not only continue to occur but would also become more severe. As more of the main stream channels filled with sediment, more of the smaller tributaries would become blocked and swamping would become a greater problem in the watershed.

The continued flooding and sediment deposition would also have a detrimental effect on the watershed wildlife resource. Many of the larger trees are severely damaged by the deep sediment deposits and their life span is drastically reduced. Smaller trees and shrubs are often killed the same year the sediment is deposited. Consequently, woodland wildlife habitat would be reduced in the floodplain.

SHORT-TERM VS LONG-TERM USE OF RESOURCES

The land use in this watershed is primarily for agricultural production. The land use trend has been a decrease in cropland, rangeland, and forest, and an increase in tame pasture and house locations. The projected land use with and without project is as follows:

Land Use	: Without Project		: With Project	
	: Acres	: Percent	: Acres	: Percent
Cropland	16,454	10	17,650	11
Tame Pasture	42,781	26	44,000	27
Rangeland	56,460	34	52,950	32
Forest	44,805	27	43,719	26
Urban and Miscellaneous	4,800	3	6,981	4
Total	165,300	100	165,300	100

The land treatment program is flexible for meeting the needs of changing land uses in order to conserve the soil, water, and vegetative resources for the future.

A coordinated plan identified as the Central Oklahoma Project has been investigated by the Corps of Engineers. This study covered alternative proposals for meeting water resource needs of the Central Oklahoma area. Considered in the planning objectives of the project were navigation, flood control, drainage, recreation, fish and wildlife conservation, water supply, water quality control irrigation, and power generation. The measures included in the Kickapoo Nations Watershed work plan will be integrated into the overall plan for the basin, but will exert little effect with the exception of a small reduction in sediment contributed to Eufaula Reservoir and a slight decrease in flood stages on the Deep Fork River.

There are several Public Law 566 watershed projects in the vicinity of the Kickapoo Nations Watershed. Most of these projects are in various stages of completion. When all are completed, their collective influence is expected to significantly reduce flooding with all of its attendant damages and associated problems. The Kickapoo Nations Watershed project should make a small, but significant, contribution to this reduction.

This plan provides a level of protection consistent with the needs and objectives of present and anticipated use of the floodplain lands.

It provides protection for some of the most productive land in the watershed and it will aid in the orderly development of the natural resources of the area. The plan gives consideration to conservation and environmental measures to preserve the land for use by future generations. The structural measures are evaluated for a 100-year period. At the end of this period, the structures are expected to remain useful in the reduction of floodwaters.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The labor, energy for construction, and a portion of the materials are totally committed resources in this project. In addition, about 1,698 acres of land devoted to sediment pools, dams, and spillways will be removed from agricultural production. Of this amount, about 564 acres are in cropland, about 1,011 acres are in grassland, and 123 acres are in timber. These areas will be lost from agricultural production for the life of the project. Agricultural production on the 1,987 acres involved in the detention pool area of the structures will also be restricted during periods of high water. This restriction will exist for the life of the project.

CONSULTATION AND REVIEW WITH APPROPRIATE AGENCIES AND OTHERS

General

When planning activities were authorized, the Soil Conservation Service mailed an announcement to all concerned federal and state agencies that a watershed plan was to be developed for the Kickapoo Nations Watershed. This announcement invited each agency to participate and make contributions to the plan.

A biological reconnaissance of the watershed was made by personnel from the Oklahoma Department of Wildlife Conservation, U.S. Fish and Wildlife Service, and the Soil Conservation Service. Wildlife habitat considerations and mitigation measures discussed in the biological reconnaissance report were included in plan development.

The City of Chandler determined that an additional municipal water supply was needed. The city hired a consulting engineering firm to make a feasibility report and requested that a structure be considered for municipal water. The report showed that the selected site would hold water, that the supply would be ample to supply the city's needs, and that the water quality would be suitable for the planned uses. The town of Wellston also requested that a study be made to add municipal water to a nearby site. However, they later withdrew their request.

Public meetings were held at Chandler in December 1968, May 1969, April 1972, November 1973, and March 1975. Meetings were also held at Wellston; two in September and one in October 1969 and one in January 1972. More frequent meetings were held with the sponsors and the steering committee in the course of planning the project. Floodwater, land treatment, water management, and environmental problems were examined by the local sponsors, interested groups, and the Soil Conservation Service. Measures to provide answers to these problems were discussed with the sponsors and other interested groups.

After a project had been formulated to meet the objectives of the sponsors, a public meeting was called. Invitations were sent to concerned federal, state, and local agencies. All other groups and individuals were encouraged to attend through newspaper notices. A large watershed map showing the location of each floodwater retarding structure was displayed at this meeting. Each site location was discussed individually and comments requested. The participants were informed that comments would be accepted verbally or by mail. No protests against this proposed plan have been received.

During the formulation of this project, discussions were held with the local sponsors and landowners of site locations about water quality, sanitation and recreation.

Displacement of people, businesses and farm operations were discussed with sponsors and site committees during project formulation and every effort was made to prevent any type of displacement.

Two professional archeologists have surveyed the archeological resources in the watershed and results of their surveys are available.

The state archeologist, state historic preservation officer, and the director of the Historic Sites Division of the Oklahoma Historical Society were consulted during the assessment of the archeological and historical resources. Continued consultation and cooperation with these individuals and the archeologist employed by the Oklahoma Conservation Commission will be pursued through the final installation stages of the project.

Consultation with the Secretary of Interior will be continued through the installation phases of the project to insure that scheduling of appropriate action on these resources will not delay construction activities.

Agencies and organizations from which written comments were requested during interagency review and an indication of their response is indicated below:

- Department of the Army - Response by letter dated 6-20-77
- Department of Commerce - No response
- Department of Health, Education and Welfare - Response by letter dated 6-10-77
- Department of the Interior - Response by letter dated 6-29-77
- Department of Transportation - Response by letter dated 5-22-77
- Environmental Protection Agency - Response by letter dated 5-12-77
- Office of Equal Opportunity, USDA - No response
- Federal Power Commission - No response
- Oklahoma Historic Preservation Officer - No response
- Governor of Oklahoma - No response
- State Clearinghouse - Response by letter dated 6-10-77
- Regional Clearinghouse - No response
- Natural Resources Defense Council - No response
- Friends of the Earth - No response
- Environmental Defense Fund - No response
- National Wildlife Federation - No response
- National Audubon Society - No response
- Environmental Impact Assessment Project - No response
- Isaac Walton League, Oklahoma Chapter - No response
- Sierra Club, Oklahoma Chapter - No response
- Oklahoma Wildlife Federation - No response
- Tulsa Audubon Society - No response

The summarization of each environmental issue, problem or objection raised during the formal review of the Draft Environmental Statement and the final work plan follows:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Comment 1 - Page E-13 - Describe the waste disposal system. If there is a discharge, describe the quantity and quality of effluent and note that a National Pollutant Discharge Elimination System permit will be required.

Response: The wording on P-9 and E-13 is changed to read as follows: "Each of the comfort stations will be equipped with a septic tank and subsurface tile to serve as the waste disposal system. The system will be installed and serviced in accordance with Oklahoma Department of Health Bulletin #600."

It is expected that no effluent will be discharged from the system thus the suggested permit will not be needed.

Comments 2, 3, and 4 are directed toward noise, dust, erosion generated during the construction process; the use of pesticides and herbicides, and application methods; and the provisions for collecting and disposing of solid waste.

Response: P-8 of the plan and E-12 of the EIS have been modified to clarify actions to be taken to minimize noise, air, and water pollution from construction related activities as follows:

"Each construction contract will require the contractor to adhere to applicable provisions of the Clean Air and Federal Water Pollution Control Acts to minimize noise, air, and water pollution."

"Occupational noise exposure will be kept to safe levels by the use of suppressant devices or through use of personal protection equipment. Standard sound level meters will be used to monitor construction activities, assuring that neither workers nor inspectors will be exposed to harmful noise levels beyond that specified by the Labor Department Standards. Air, erosion, and water pollution will be held to a practical minimum by such practices as: 1) reducing the area and duration of exposure of earth fill and earth fill source areas; 2) stocking and replacing top soil on disturbed areas; 3) mulching areas likely to produce significant erosion; 4) sprinkling of earth fill source areas and other disturbed areas to minimize the production of dust; 5) scheduling and completing work by segment, where possible; 6) establishing erosion control vegetation or other pollution abatement measures as soon after work is completed as practical; 7) providing acceptable means of disposal of fuels and lubricants resulting from the operation; 8) providing sanitary facilities for disposal of sewage resulting from construction

activities; 9) disposing of solid waste such as material cleared from the site, and that generated through construction activity in accordance with state regulations."

"The use of pesticides and herbicides are not anticipated in the installation and operation and maintenance of this project. However, should this use become necessary, all applications will be consistent with the Federal Insecticides, Fungicides, and Rodenticides Act, as amended."

An additional response to Comment 4: Page P-25 and E-16 have been modified by addition of the following sentence: "Collection and disposal of solid waste in connection with operation and maintenance of the recreation facilities will be handled by the City of Chandler Sanitation Department in the same manner as for the City."

U. S. DEPARTMENT OF TRANSPORTATION - U.S. Coast Guard

Comment 1 - The recreational use of the multipurpose reservoir indicates boater education and boating safety should have a role in the operation of this project.

Response: Boating safety will be considered in the rules and regulations for use of the lake and recreation facilities. Regulation of activities, including safety, on and around the lake is the responsibility of the City of Chandler, as stated on page E-16, paragraph 3.

Comment 2 - If the proposed reservoir is judged to be a freshwater reservoir as defined in 40 CFR 140, planning should consider the need for sewage pumpout and treatment facilities for the marine sanitation devices of recreational vessels.

Response: Since the lake is a municipal water supply, boats with marine sanitation devices will not be allowed on the lake.

Comment 3 - If boat fueling facilities are to be provided, the need for prevention and control of oil spills should receive consideration.

Response: The city does not plan to provide such services and commercial operations are prohibited by law.

Comment 4 - The Department of Transportation has no other comments to offer nor do we have any objection to this project. The final statement, however, should address the concerns of the Coast Guard.

Response: Noted

DEPARTMENT OF THE ARMY

Comment 1 - They had reviewed the document, could see no conflict with any of their projects, and considered the EIS satisfactory.

Response: Noted

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Comment 1 - Concerned the absence of comments about approximately 30 Indian families living in the area.

Response: The Bureau of Indian Affairs has reported that there is only one tract of Indian trust land within the watershed. Other Indians might live within the watershed. However, minority information is obtained from U.S. Census data, and minority numbers that make up less than 1 percent of the population are not included in the published data.

Comment 2 - Concerned the possibility of the project providing a source of water for Rural Water Districts.

Response: The City of Chandler will, for some years after completion of the project, have excess water which could be sold to Rural Water Districts. It is anticipated that water will be supplied to several rural areas under a Trust Authority arrangement. However, such plans are tentative and therefore were not discussed in the plan and EIS.

UNITED STATES DEPARTMENT OF THE INTERIOR

General Comments - Plan and Environmental Impact Statement

Comment 1 - The land treatment objective of this study effort is not clearly stated. The plans for mitigation are inadequately detailed. Our specific comments will display this.

Response: Land treatment is not an objective. It is one of the methods of achieving the objectives. In this case, objectives are to reduce erosion, sediment, and flooding. Response to mitigation is included under the various specific comments.

Comment 2 - Had to do with the effect of construction on oil and gas production and stated that this effect was not listed in the document.

Response: Table 3 shows that areas involved in sediment pools vary from 10 to 1,070 acres. Most of these sites (15) are less than 40 acres in size. Normally producing oil wells are either avoided during planning or diked out. Existing pipelines are relocated by laying the new line and then tying into the existing line so that service is interrupted for only a short time. Any new wells can be offset outside of the site

areas, or if land rights require drilling within the pool areas, the sites can be drained until a drilling pad can be constructed. In view of the above, we find there will be no significant impacts on future oil or gas production including secondary recovery.

Comment 3 - Concerned Indian land within the watershed and stated that the USDI believed that there would be no significant impact on Indian lands or interests.

Response: Noted.

Comment 4 - The work plan should identify that the project is along tributary streams of the Deep Fork River.

Response: This information has been added to page P-1 of the plan and page E-19 of the EIS.

Specific Comments - Plan and Environmental Statement

Comment 1 - Page P-2 - Concerned a discrepancy in acres of woodland habitat which would be destroyed.

Response: The document has been changed to reflect the correct figure on pages P-2 and P-6.

Comment 2 - Page P-7 It is stated that wildlife plantings will be incorporated in the erosion control plans of nine selected sites. The Fish and Wildlife Service should be consulted for development of these plantings at the selected sites, and the location and type of plantings should be included in the final plan.

Response: Erosion control plans will be developed for the 20 floodwater retarding structures. Investigation showed that nine of these sites will affect important fish and wildlife resources. Thus nine of the erosion control plans will identify one- to two-acre plots totalling about 25 acres for plantings to mitigate for fish and wildlife habitat losses. Sponsors of the plan and the SCS will commit themselves to the mitigation plantings when they sign the plan. Land easements and rights of way for the structures, structure designs, and the erosion control plans will be developed after congressional approval of the plan. The Fish and Wildlife Service will be invited to participate in the design of the plantings.

Page P-19 and E-12 have been modified by addition of the following statement "The SCS will provide technical assistance for development of erosion control plans including the plantings to mitigate wildlife habitat losses. The Fish and Wildlife Service will be invited to participate in the design of the habitat plantings."

Comment 3 - Pages P-8, E-27, and E-45, concerned the fact that the William Tilghman homestead was listed on the National Register of Historic Places and that the impact of the project on this historical site was not discussed.

Response: The plan and EIS have been modified on the above listed pages to show that the William Tilghman house was included in the National Register of Historic Places and that it will not be impacted by project measures.

Comment 4 - Page P-11, concerned additional detail and clarification for the eight acres of mitigation plantings proposed for the multipurpose site.

Response: The eight acres of mitigation shown on page P-11 is merely a listing of items showing what was included in the construction cost of the multipurpose structure. More explicit information concerning mitigation measures is shown in the Planned Project Section of the EIS on page E-11.

Comment 5 - Page P-25, concerned fencing and the grazing or other uses of the wildlife mitigation measures.

Response: Pages P-7, P-25, and E-11 have been modified to show that the mitigation plantings will be fenced to restrict grazing.

Specific Comments - Environmental Impact Statement

Comment 1 - Page E-1, suggested a change in wording to provide clarification for the location of recreational facilities.

Response: The suggested change, with some modification, has been made on page E-1.

Comment 2 - Page E-1, concerned adding the land treatment measures to the summary of impacts.

Response: The suggested change has been made on page E-2.

Comment 3 - Page E-1, misunderstanding is promoted by the statement: "Wildlife populations will become more stable in the floodplain due to fewer drownings of young and destruction of den areas by floodwaters and sediment." While stabilization of an unreduced or even increased floodplain wildlife population can be construed, a depressed and less diverse population can be anticipated - the usual product of agricultural intensification.

Response: It is generally accepted that a change from non-intensive agriculture and natural conditions to intensive agriculture will result in less diversity in the biota. In this case, under present conditions,

92 percent of the protected floodplain is in agricultural use. (Crop, 51 percent; tame pasture, 26 percent; range, 15 percent.) Projections for "future without project" show virtually no change from the present land use. Installation of the project will cause a 14 percent increase in crop, with a corresponding decrease of 11 percent and 3 percent respectively, in tame pasture and range. Miscellaneous areas which include 6 percent timber located primarily in rough areas along streams will experience little, if any, change. The anticipated intensification could occur only in conversion of the 14 percent pasture (mostly bermuda) and range to crop. It appears more likely that intensification caused by this project will be shown in management practices and an increase in the diversity of crop species. For these reasons, the diversity of wildlife species is not expected to decrease nor are the wildlife populations expected to become depressed.

Comment 4 - Page E-1, in addition to better recognition of floodplain changes, a comprehensive statement of upstream destruction of wildlife habitat should be provided.

Response: The information provided on page E-1 is a brief summary of the impacts. Discussions on pages E-40, E-41, E-46, and E-47 provide more detailed information on this subject.

Comment 5 - Page E-2, the discussion states that 628 acres of land will be lost to agricultural purposes for 50 years. We question if it is anticipated that this land will return to agricultural use as the sediment accumulates, and if the detention action of these 19 structures will end in 50 years. The discussion on this page does not correlate with the discussion on pages E-10 and E-11, which identifies structure design life at 100 years and sediment filling time at 50 years.

Response: You are correct. The affected areas will not return to agricultural production for the life of the project. Page E-2 has been corrected.

Comment 5 - Page E-7, although only 130 acres of timber are located in the floodplain (E-22), reduction in bottomland hardwood loss is rated to decrease "from 500 to 200 acres per year." The discrepancy in values should be clarified.

Response: We were in error. The figures on page E-7 should have reflected losses in the entire watershed. The document has been corrected to reflect this fact.

Comment 6 - Page E-7 - Apparently there will be 71,000 acres of land in the watershed without treatment. A footnote should be added on page E-7 or E-9 to state that fact and give a brief explanation of why treatment is not planned.

Response: An inventory was made of the watershed land to determine its use, conservation and management practices needed and on the land. In response to your comments and those of other agencies, the entire land treatment portion of the plan was re-evaluated and several changes have been made. The plan now reflects that less than 39,000 acres are not scheduled for treatment or have not been treated previously. The 126,500 acres shown on page E-7 represents the projected acres of land with adequate treatment which will be in the watershed at the end of the project installation period.

Comment 7 - Page E-23 - Although on E-23 the statement declares that no wetlands occur in the watershed, wildlife wetland development of 15 acres is listed on P-36. Please resolve this conflict in the final presentation.

Response: The statement on E-23 is correct and Page P-36 has been corrected.

Comment 8 - Page E-26 - It is stated that 215 surface acres of fish habitat comprised of farm ponds and the Deep Fork River occur in the watershed. The exclusion of Chandler and Warwick Lakes with their combined area of 250 acres should be explained.

Response: The Chandler and Warwick lakes were inadvertently omitted. The document now reflects their presence.

Comment 9 - Page E-27 - Stated that the document showed a need and a potential for waterbased recreation in association with the structures. However, the USDI felt that this potential was discouraged because the document stated that the private landowner was responsible for providing adequate sanitary facilities where public access was allowed.

Response: Current legislation requires that the owner or operator of a public access recreational facility must provide adequate sanitary facilities. We agree that this law could discourage potential development of these sites.

Comment 10 - Page E-28, was concerned with the status of land treatment throughout the documents and asked for a listing of specific measures and the percentage of each completed.

Response: Information in Table 1, page P-35, shows the amount of funds expected to be expended for land treatment during the project period. This data is provided for the different types of land use. However, since each land use has anywhere from 10-15 conservation practices which could be applied, it was felt that the table would become so cumbersome that it would no longer be useable if they were all included. However, Table 1A, page P-36, does include specific conservation practices which

have been installed within the watershed. A selection of the major practices are shown as indicators of the status of the works of improvement within the watershed.

Comment 11 - E-29 - The proposed Arcadia Reservoir, 10 miles upstream from the Kickapoo Nations Watershed boundary, will reduce flooding along the Deep Fork River. A flood-reduction cross section for the Deep Fork River, similar to that for the Kickapoo Nations Watershed on E-44, could be included.

Response: Flood control on the Deep Fork River comes under the jurisdiction of the U.S. Army Corps of Engineers. The SCS does not have funds or authority to make this kind of an evaluation.

Comment 11 - Page E-48 - Conflict between the E-48 statement of an annual benefit of \$88,410 and the P-43 benefit of \$72,150 is noted. Correction or an explanation would be appropriate.

Response: The \$72,150 on page P-43 (footnotes 3, 4, and 5) must be added to the \$16,620 shown in Table 6 footnote 4 to get the total \$88,410 as shown on page E-48.

Comment 12 - Page E-36 - Concerned the listing of the birds on this page as rare or endangered.

Response: The document has been modified to better explain the status of the birds listed.

Comment 13 - Page E-38 - The figure for acreage of land to be treated appears to be 14,050 acres rather than 15,050. (See pages E-7 and E-9).

Response: The re-evaluation of the land treatment section has resulted in a change in this figure as explained in the response to Comment 6 above.

Comment 14 - Page E-39 - The discussion of impacts of structural measures seems to assume that all land treatment measures are accomplished. This assumption should be discussed in this paragraph.

Response: Land treatment measures, for project purposes, are not considered as structural measures. They are discussed in the preceding section beginning on page E-38.

Comment 15 - Page E-39 - It is stated that many critical areas will be fenced. It is our understanding that harvesting is to be precluded, except for management purposes, as a condition for Federal cost sharing assistance. This would appear to require fencing. It would be helpful to know just how many of the 338 critical areas slated for assistance are to be fenced.

Response: It will be impossible to determine the number of the critical areas which will be fenced until the exact type of treatment for each specific critical area is planned. Deferment is generally required until the vegetation has become established. Frequently, landowners work this deferment period into rotational grazing systems so that the entire pasture is deferred. Others use electric or other types of fencing until the vegetation is established. Permanent fencing would be required when the farmer and the planner agree that grazing should be prohibited.

Comment 16 - Page E-45 - Concerned the effects of local groundwater recharge in the immediate vicinity of some of the structures.

Response: The document has been expanded on page E-46 to discuss these effects.

Comment 18 - Page E-47 - Derivation should be provided for the "more than 800 acres" increase in wildlife habitat.

Response: Due to the critical area treatment there are several areas of essentially "new" habitat which will be added to the watershed. However, since the benefit to wildlife of these areas may be controversial, the above statement has been deleted from the document.

Comment 17 - Page E-46 - Habitat loss is incompletely comprehended in the statement: "The destruction of about 123 acres of forested range in the sediment pool areas of the structures will result in a decrease in woodland wildlife habitat---." Cropland and grassland habitat losses totaling 1,575 acres will as well occur and additional direct losses will be sustained in the 103-acre area of dams and spillways and in borrow areas. Indirect losses will be attributable to the project.

Response: The document has been expanded on page E-46 to discuss the cropland and grassland losses.

Comment 19 - Page E-48. An annual benefit of \$56,490 is stated for changed land use. The impact on wildlife habitat, possibly adverse, should be addressed here.

Response: This impact has been considered and the monetary benefit is reflected in the figure for indirect damage reduction benefits. See comment 3 above for the effect of floodplain land use changes on wildlife.

Comment 20 - Page E-52 - To determine the importance of the loss of 123 out of 47,000 acres of woodland, you should identify how much is bottom-land (91 out of 123) and also the total bottomland timber acreage within the watershed in order to correctly assess the impact of this loss as valuable wildlife habitat.

Response: Page E-52 has been modified to reflect the 91 acres of bottom-land hardwoods and that there are presently about 1,957 acres of bottom-land hardwoods in the watershed.

Comment 21 - Page E-52 - Stated that pesticide application was expected to increase in the future and that the chemical concentration in the sediment would partially offset downstream water quality improvement due to sediment trappings. It also stated that a permanent decrease in downstream flow could be expected from increased crop yields, lake evaporation, and the City of Chandler water supply and would compound water pollution in the immediate future. USDI thought these water quality considerations should be addressed in the EIS.

Response: Recent legislation has resulted in a major change in the types of pesticides available for use by the general public. The pesticides which are now available break down in the soil quite rapidly to harmless compounds. Consequently, water quality should improve not only due to trapped sediment with the attached pesticides, but also since the rapid conversion of these pesticides to harmless compounds will occur, there will be smaller amounts available to be washed into streams. Study results of the effects of a similar project on pesticide concentrations are reported on page E-43 and E-44. These results appear to be a better guide in determining future effects on pesticides.

Comment 22 - Page E-53 - Non-viability of the accelerated land treatment alternative alone should be better explained. The "small" beneficial effect in terms of the watershed's wildlife, which is attributed to this alternative, is noted to be a "highly" beneficial effect where land treatment is considered as part of the selected plan on page E-39.

Response: The conflict in the effects of land treatment on wildlife habitat has been eliminated from pages E-39 and E-53. The non-viability of the "land treatment alone" alternative is not influenced by the alternative's effect on wildlife. In essence, a viable plan is one which can be implemented with assistance under existing USDA authorities and for which a public body has expressed a willingness to implement. In this case, the major problems are flooding and damages associated with flooding. Since land treatment alone will not solve the major problem, it is unacceptable to the sponsors, and hence non-viable.

Comment 23 - Page E-54 - Alternative 2 states that a major farm market road will continue to be flooded. It would seem that the same road would also continue to be flooded under conditions of alternative 1.

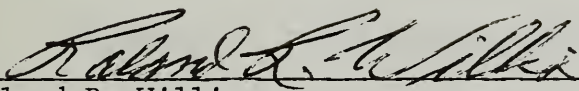
Response: Since alternative 1 has only a minor effect on flooding, your assumption is correct.

Comment 24 - Pages E-54 and 55 - On comparison of alternatives 2 and 4, the NED plan 2 provides excess benefit over cost and therefore seems superior to the chosen plan 4. The basic determinant for selecting plan 4 appears to be the elimination of inundation of a major farm-to-market road. Yet, there is no apparent gain reflected in annual monetary benefit. There appears to be less national efficiency and no apparent environmental gains in alternative 4 through protection of the road. The rationale of tradeoffs in selecting alternative 4 over 2 should be addressed in the work plan under EQ planning and not in the EIS.

Response: Several changes have been made in the plan and EIS to clarify the environmental and social well-being effects of the selected plan. Chief among these was a numerical error which showed that the costs were not nearly as great as originally shown. The chosen plan was selected because of the significant environmental and social well-being benefits which could be achieved by the addition of two structures for only a small additional cost. The increased net annual cost for the additional environmental quality features of the selected plan is \$5,225 when compared to the benefits of the NED plan.

The environmental effects of these additional structures will improve water quality and reduce flooding, erosion, and sediment deposition in the floodplain. This will result in a general overall improvement in the bottomland wildlife and stream ecosystems. In addition, the social well-being benefits of flood protection and income stabilization will occur.

Approved by:



Roland R. Willis

October 21, 1977

Date

APPENDICES

Appendix A - Display Accounts for Selected Alternative

Appendix B - Summary Comparison of Alternative Plans

Appendix C - Project Map

Appendix D - Multipurpose Reservoir Development Map

Appendix E - Chandler Urban Flood Hazard Map

Appendix F - Letters of Comment Received on the Draft EIS -

Appendix G - Bibliography

APPENDIX A

DISPLAY ACCOUNTS FOR SELECTED ALTERNATE

National Economic Development Account

Environmental Quality Account

Regional Development Account

Social Well-Being Account

SELECTED ALTERNATIVE

NATIONAL ECONOMIC DEVELOPMENT ACCOUNT
Kickapoo Nations Watershed, Oklahoma

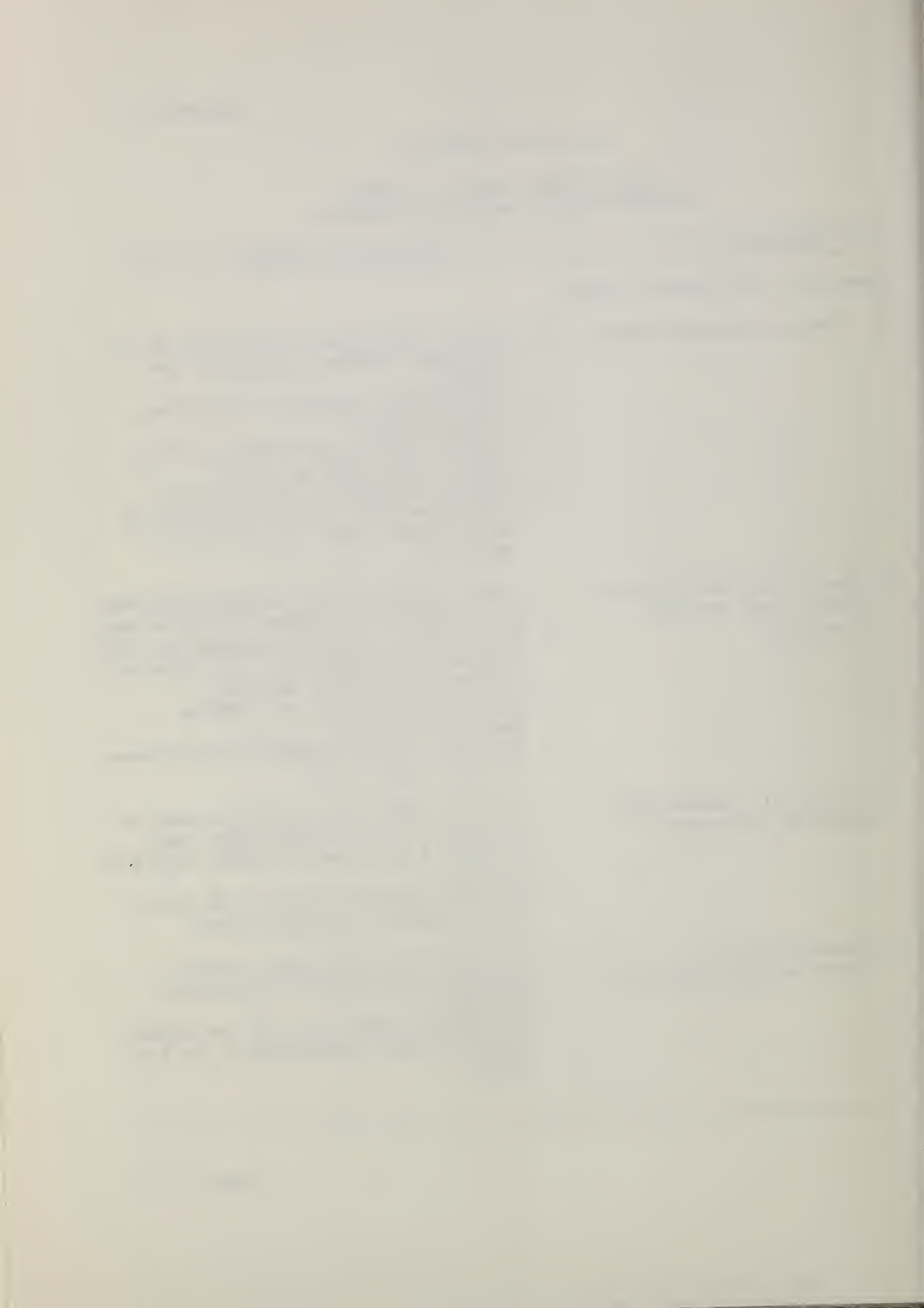
Components	Measures of Effects ^{1/}	Components	Measures of Effects ^{1/}
Beneficial effects:			
A. The value to users of increased outputs of goods and services:		A. Adverse effects:	
1. Flood prevention	\$342,670	A. The value of resources required for a plan:	
2. Recreation	139,500	1. 1 multipurpose and 19 floodwater retarding structures and recreational facilities	
3. Municipal water supply	338,000	Project installation	\$388,872
4. Utilization of unemployed labor and underemployed labor resources		OM&R	39,350
a. Project construction	33,240	2. Project administration	52,383
b. Project OM&R	7,400		
Total Beneficial Effects	\$860,810	Total Adverse Effects	\$480,605
		Net Beneficial Effects	\$380,205
^{1/} Average Annual.			

August 1977

SELECTED ALTERNATIVE

ENVIRONMENTAL QUALITY ACCOUNT
Kickapoo Nations Watershed, Oklahoma

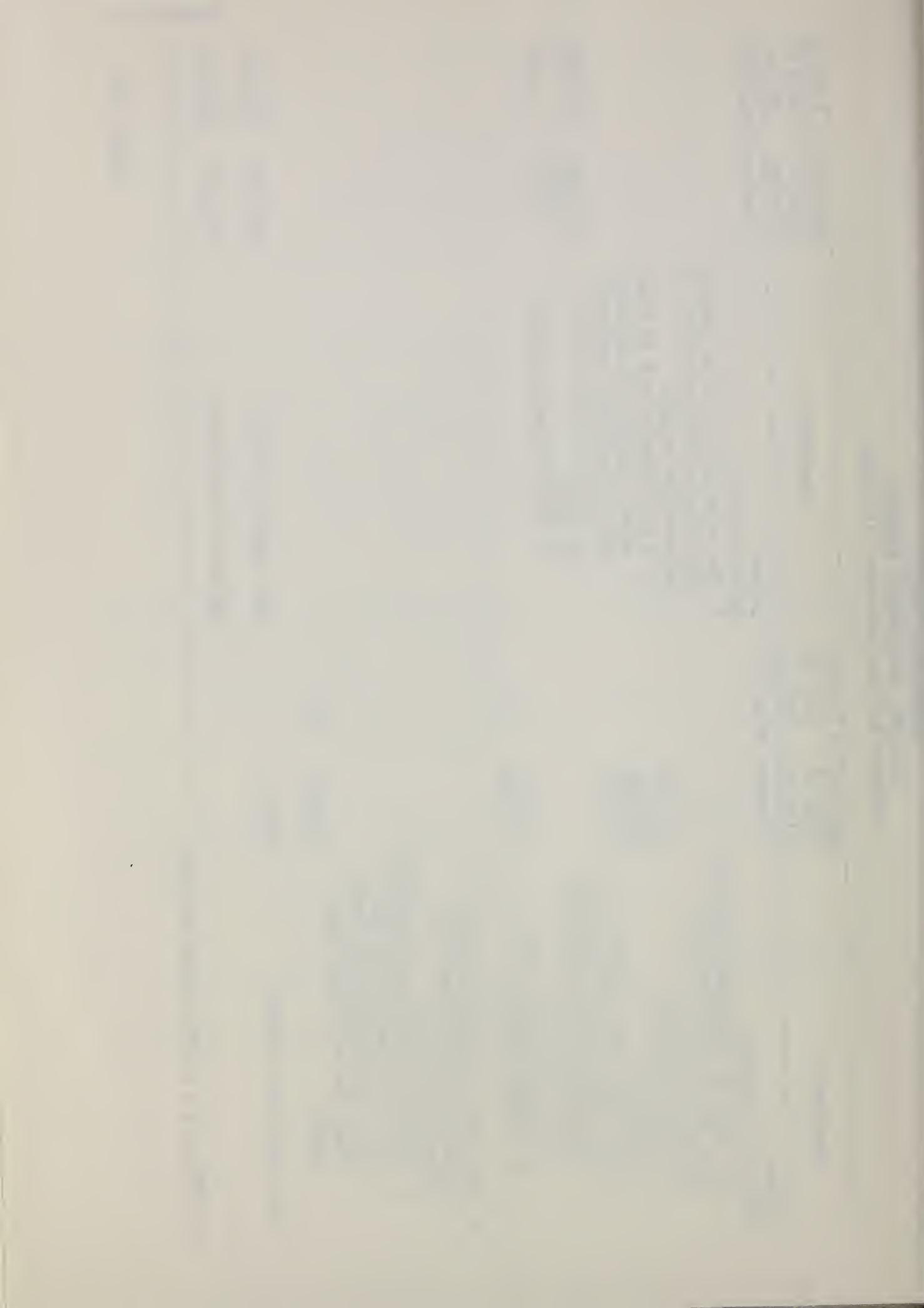
Components	Measures of Effects
Beneficial and Adverse Effects:	
A. Areas of natural beauty.	<ol style="list-style-type: none"> 1. Create 1,698 acres of lake area at 20 locations scattered throughout the uplands. 2. Intermittent inundation 1,640 acres of pastureland. 3. Average annual acres flooded will be reduced from 5,786 to 2,502. 4. Create multipurpose lake providing recreation facilities, 1,070 acres of water surface area, and 20 miles of shoreline.
B. Quality considerations of water, land, and air resources.	<ol style="list-style-type: none"> 1. Reduce average annual sediment delivery to Eufaula Res. by about 71.5 acre-feet. 2. The acres of floodplain damaged by sediment will be reduced by 1,131 acres as a result of structural measures. 3. Stabilize base flows and improve quality of streams. 4. Decrease critical sediment source areas by about 2,045 acres.
C. Biological resources and selected ecosystems.	<ol style="list-style-type: none"> 1. Provide 1,698 acres of resting area at reservoirs for migratory water fowl. 2. Inundate 1,698 acres of former wildlife habitat. 3. Provide wildlife habitat at 20 flood-water retarding structure sites.
D. Irreversible or irretrievable commitments.	<ol style="list-style-type: none"> 1. Conversion of 1,698 acres pasture, woodland, and cropland to permanent lake area. 2. An area of 1,987 acres will be subject to intermittent inundation in the site areas.



SELECTED ALTERNATE
REGIONAL DEVELOPMENT ACCOUNT
Kickapoo Nations Watershed, Oklahoma

Components	Measures of Effects		Components	Measures of Effects	
	State of Oklahoma	Rest of Nation		State of Oklahoma	Rest of Nation
	(Average Annual) ^{1/}			(Average Annual) ^{1/}	
Income.			Income.		
Beneficial effects:			Adverse effects:		
A. The value of increased output of goods and services to users residing in region			A. The value of resources contributed from within the region to achieve the outputs		
1. Flood prevention	342,670	-	1. 1 multipurpose and 19 flood-water retarding structures		
2. Recreation	139,500	-	and recreational facilities		
3. Municipal water supply	338,000	-	a. Project installation	147,060	241,812
4. The utilization of regional unemployed or underemployed labor resources			b. OM&R	39,350	0
a. Project construction	33,240	-	c. Project administration	3,070	49,313
b. Project OM&R	7,400	0			
B. The value of output to users residing in the region from external economies					
1. Indirect activities associated with increased net returns from flood prevention, recreation, and municipal water supply	62,840	NA			
Total Beneficial Effects	923,650	-	Total Adverse Effects	189,480	291,125
			Net Beneficial Effects	734,170	-291,125

^{1/} 100-years @ 6.125 percent interest.



SELECTED ALTERNATIVE
REGIONAL DEVELOPMENT ACCOUNT
(Cont'd)
Kickapoo Nations Watershed, Oklahoma

Components	Measures of Effects		Rest of Nation
	State of Oklahoma		
Employment - Beneficial Effects:			
A. Increase in the number and types of jobs.			
1. Agricultural employment.		Equivalent of 18.5 permanent semi-skilled jobs in agriculture production.	-
2. Employment in recreation service sector.		Equivalent of 4 permanent semi-skilled jobs.	-
3. Employment in municipal water supply sector.		Equivalent of 1 permanent semi-skilled job.	-
4. Employment for project construction.		83 man-years of employment during project construction.	-
5. Employment for project OM&R.		5.5 permanent semi-skilled jobs.	-
TOTAL BENEFICIAL EFFECTS		Equivalent of 29 permanent semi-skilled jobs. 83 man-years of employment during project construction.	-
Employment - Adverse Effects:			
A. Decrease in number and type of jobs.			
1. Lost in agricultural employment of project lake area.		-	-
TOTAL ADVERSE EFFECTS		-	-
NET BENEFICIAL EFFECTS		29 permanent semi-skilled jobs. 83 man-years of employment during project construction.	-

Appendix A

SELECTED ALTERNATIVE

REGIONAL DEVELOPMENT ACCOUNT
(Cont'd)

Kickapoo Nations Watershed, Oklahoma

Components	Measures of Effects	
	State of Oklahoma	Rest of Nation
Population Distribution.		
Beneficial effects:	Creates 29 permanent semi-skilled jobs and 83 man-years of employment during project construction in an area that has experienced minor population growth over the last 10 years.	-
Adverse effects:	-	-
Regional Economic Base and Stability.		
Beneficial effects:	Creates 29 permanent semi-skilled jobs and 83 man-years of employment during project construction in an area that has been designated as a Title IV redevelopment area under the Public Works and Economic Development Act. The designation was made on the basis of substantial unemployment.	-
Adverse effects:	-	-

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SELECTED ALTERNATIVE
SOCIAL WELL-BEING ACCOUNT
Kickapoo Nations Watershed, Oklahoma

Components	Measures of Effects																								
Beneficial and Adverse Effects:																									
A. Real income distribution.	<div><div>1. Create 29 permanent semi-skilled jobs and 83 man-years of employment during project construction.</div><div>2. 75 owners and operators of floodplain land will be directly benefited by reduced flood damage to crops, pasture, and improvements. This source of benefits will amount to \$213,420, annually.</div><div>3. Urban property owners will benefit directly due to reduced flood damages to homes and businesses. This source of benefits will amount to \$6,300 annually.</div><div>4. Regional income stability and growth will occur as a result of the over-all project which includes recreation facilities and municipal water supply in addition to flood prevention.</div><div>5. Create regional benefits distribution of \$923,650 by income class as follows:</div><table><tr><td>Inc. Class (Dollars)</td><td>% of County Inc. in Class</td><td>Percent Ben. Dist. to Class</td></tr><tr><td>Less than 3,000</td><td>22</td><td>5</td></tr><tr><td>3,000 to 10,000</td><td>55</td><td>60</td></tr><tr><td>More than 10,000</td><td>23</td><td>35</td></tr></table><div>6. Local costs to be borne by region total \$189,480 with distribution by income class as follows:</div><table><tr><td>Inc. Class (dollars)</td><td>% of County Inc. in Class</td><td>Percent Cost Cont. by Class</td></tr><tr><td>Less than 3,000</td><td>22</td><td>5</td></tr><tr><td>3,000 to 10,000</td><td>55</td><td>60</td></tr><tr><td>More than 10,000</td><td>23</td><td>35</td></tr></table></div>	Inc. Class (Dollars)	% of County Inc. in Class	Percent Ben. Dist. to Class	Less than 3,000	22	5	3,000 to 10,000	55	60	More than 10,000	23	35	Inc. Class (dollars)	% of County Inc. in Class	Percent Cost Cont. by Class	Less than 3,000	22	5	3,000 to 10,000	55	60	More than 10,000	23	35
Inc. Class (Dollars)	% of County Inc. in Class	Percent Ben. Dist. to Class																							
Less than 3,000	22	5																							
3,000 to 10,000	55	60																							
More than 10,000	23	35																							
Inc. Class (dollars)	% of County Inc. in Class	Percent Cost Cont. by Class																							
Less than 3,000	22	5																							
3,000 to 10,000	55	60																							
More than 10,000	23	35																							
B. Life, Health, and Safety	<div><div>1. Provide flood protection in the City of Chandler from the 100-year frequency storm and thus decrease the chances for loss of life.</div><div>2. Flash floods that result in rapid inundation of roads and floodplain that endanger the lives of people will be decreased.</div><div>3. Tension and worry, as a result of floods, will be reduced.</div></div>																								
C. Recreational Opportunities	Creates 62,000 recreation day activities.																								

APPENDIX B

SUMMARY COMPARISON OF ALTERNATIVE PLANS

SUMMARY COMPARISON OF ALTERNATIVE PLANS
Kickapoo Nations Watershed, Oklahoma

Account			
National Economic Development		National Economic Development Plan	Environmental Quality Plan
Beneficial Effects	\$ 860,810	\$ 855,690	\$ 878,270
Adverse Effects	480,605	470,260	766,560
Net Beneficial Effects	380,205	385,430	111,710
<u>Environmental Quality</u>			
Beneficial and Adverse Effects:			
A. Areas of Natural Beauty			
	<ol style="list-style-type: none"> 1. Create impoundments with a surface area of 1,698 acres. 2. Intermittent inundation of 1,987 acres in the detention pools. 3. Improve watershed esthetics in the vicinity of 20 small lakes. 4. Average annual acres flooded will be reduced by 3,284 acres. 5. No effect. 	<ol style="list-style-type: none"> 1. Create impoundments with a surface area of 1,671 acres. 2. Intermittent inundation of 1,927 acres in the detention pools. 3. Improve watershed esthetics in the vicinity of 18 small lakes. 4. Average annual acres flooded will be reduced by 3,248 acres. 5. No effect. 	<ol style="list-style-type: none"> 1. Create impoundments with a surface area of 1,812 acres. 2. Intermittent inundation of 2,233 acres in the detention pools. 3. Improve watershed esthetics in the vicinity of 25 small lakes. 4. Average annual acres flooded will be reduced by 3,450 acres. 5. Create a 200-400 acre area of undisturbed "wild" setting in the natural area adjacent to the multipurpose site.
B. Quality considerations of water, land, and air resources.	<ol style="list-style-type: none"> 1. Reduce sediment delivery to Eufaula Res. by 71.5 acre-feet. 2. The amount of sediment damage to the floodplain will be reduced by 1,131 acres. 3. Reduce the floodplain acres damaged by erosion by 72.7%. 4. Improve stream base flows and improve stream water quality below 20 flood control structures. 	<ol style="list-style-type: none"> 1. Reduce sediment delivery to Eufaula Res. by 68.9 acre-feet. 2. The amount of sediment damage to the floodplain will be reduced by 1,108 acres. 3. Reduce the floodplain acres damaged by erosion by 70.9%. 4. Improve stream base flows and improve stream water quality below 18 flood control structures. 	<ol style="list-style-type: none"> 1. Reduce sediment delivery to Eufaula Res. by 75.6 acre-feet. 2. The amount of sediment damage to the floodplain will be reduced by 1,189 acres. 3. Reduce the floodplain acres damaged by erosion by 76.1%. 4. Improve stream base flows and improve stream water quality below 25 flood control structures.
C. Biological resources	<ol style="list-style-type: none"> 1. Provide 1,698 acres of resting area for migratory waterfowl at 20 scattered locations. 2. Inundate 1,698 acres of woodland and openland wildlife habitat at 20 locations. 3. Create 1,698 acres of water-oriented wildlife habitat at 20 locations. 4. Species diversity of benthic organisms will increase through 4th or 5th order streams on the tributaries below the 20 structures. 5. Macroinvertebrate colonization of low order (1st and 2nd) streams will occur below the 20 structures involved. 6. Stream environment for bottom-dwelling organisms will be improved. 7. Provide for 62,000 recreation days of watershed activity. 8. Provide an adequate water supply for the inhabitants of the City of Chandler. 9. No effect. 10. No effect. 	<ol style="list-style-type: none"> 1. Provide 1,671 acres of resting area for migratory waterfowl at 18 scattered locations. 2. Inundate 1,671 acres of woodland and openland wildlife habitat at 18 locations. 3. Create 1,671 acres of water-oriented wildlife habitat at 18 locations. 4. Species diversity of benthic organisms will increase through 4th or 5th order streams on the tributaries below the 18 structures. 5. Macroinvertebrate colonization of low order streams will occur below the 18 structures involved. 6. Stream environment for bottom-dwelling organisms will be improved over 2 less tributaries than the Selected Plan. 7. Same as Selected Plan. 8. Same as Selected Plan. 9. No effect. 10. No effect. 	<ol style="list-style-type: none"> 1. Provide 1,812 acres of resting area for migratory waterfowl at 25 scattered locations. 2. Inundate 1,812 acres of woodland and openland wildlife habitat at 25 locations. 3. Create 1,812 acres of water-oriented wildlife habitat at 25 locations. 4. Species diversity of benthic organisms will increase through 4th or 5th order streams on the tributaries below the 25 structures. 5. Macroinvertebrate colonization of low order streams will occur below the 25 structures involved. 6. Stream environment for bottom-dwelling organisms will be improved over 5 more tributaries than the Selected Plan. 7. Provide for 67,000 recreation days of watershed, historical, and nature study recreational activity. 8. Same as Selected Plan. 9. Provide 200-400 acres of woodland and openland wildlife habitat in the natural area adjacent to the multipurpose site. 10. Provide a suitable place for the inhabitants of the area to study nature in a natural setting.

SUMMARY COMPARISON OF ALTERNATIVE PLANS
Kickapoo Nations Watershed, Oklahoma

Account Regional Development - State of Oklahoma				Selected Plan	National Economic Development Plan	Environmental Quality Plan																								
A. Income																														
Beneficial Effects				\$ 923,650	\$ 917,400	\$ 945,730																								
Adverse Effects				189,480	169,080	470,920																								
Net Beneficial Effects				734,170	748,320	483,810																								
B. Employment				29 permanent semi-skilled jobs and 83 man-years of employment during 8 years of construction.	28 permanent semi-skilled jobs and 81 man-years of employment during 8 years of construction.	31 permanent semi-skilled jobs and 92 man-years of employment during 8 years of construction.																								
Social Well-Being																														
A. Real Income Distribution				1. Create 29 permanent semi-skilled jobs and 83 man-years of employment during project construction. 2. 75 owners and operators of flood-plain land will be directly benefited by reduced flood damage to crops, pasture, and improvements. This source of benefits will amount to: \$213,420 annually. 3. Regional income stability and growth will occur as a result of the over-all project which includes recreation facilities and municipal water supply in addition to flood prevention. 4. Create regional benefits distribution of \$923,650 by income class as follows: <table><tr><th>Income Class (Dollars)</th><th></th></tr><tr><td>Less than 3,000</td><td>22</td></tr><tr><td>3,000 to 10,000</td><td>55</td></tr><tr><td>More than 10,000</td><td>23</td></tr></table> 5. Local costs to be borne by region total \$189,480. These costs will be distributed by income class in the same manner as the benefits.	Income Class (Dollars)		Less than 3,000	22	3,000 to 10,000	55	More than 10,000	23	1. Create 28 permanent semi-skilled jobs and 81 man-years of employment during project construction. 2. Same as Selected Plan. This source of benefits will amount to: \$211,090 annually. 3. Same as Selected Plan 4. Create regional benefits distribution of \$917,400 by income class as follows: <table><tr><th>% of County Included in Class</th><th></th></tr><tr><td>22</td><td>5</td></tr><tr><td>55</td><td>60</td></tr><tr><td>23</td><td>35</td></tr></table> 5. Local costs to be borne by region total \$169,080. These costs will be distributed by income class in the same manner as the benefits.	% of County Included in Class		22	5	55	60	23	35	1. Create 31 permanent semi-skilled jobs and 92 man-years of employment during project construction. 2. Same as Selected Plan. This source of benefits will amount to: \$220,620 annually. 3. Same as Selected Plan. 4. Create regional benefits distribution of \$954,730 by income class as follows: <table><tr><th>% of Benefits Distributed to Class</th><th></th></tr><tr><td>5</td><td>22</td></tr><tr><td>60</td><td>55</td></tr><tr><td>35</td><td>23</td></tr></table> 5. Local costs to be borne by region total \$470,920. These costs will be distributed by income class in the same manner as the benefits.	% of Benefits Distributed to Class		5	22	60	55	35	23
Income Class (Dollars)																														
Less than 3,000	22																													
3,000 to 10,000	55																													
More than 10,000	23																													
% of County Included in Class																														
22	5																													
55	60																													
23	35																													
% of Benefits Distributed to Class																														
5	22																													
60	55																													
35	23																													
B. Life, Health, and Safety.				1. Reduce flooding by 3,284 acres each year. 2. Provide 100-year flood protection for the City of Chandler. 3. Tension and worry, as a result of floods, will be reduced. 4. A farm-to-market road in the Spring Creek floodplain will be protected from flooding.	1. Reduce flooding by 3,248 acres each year. 2. Same as Selected Plan. 3. Same as Selected Plan. 5. No effect.	1. Reduce flooding by 3,450 acres each year. 2. Same as Selected Plan. 3. Same as Selected Plan. 4. A farm-to-market road in the Spring Creek floodplain will be protected from flooding.																								
C. Recreation Opportunities				1. Create 62,000 recreation day activities. 2. No effect. 3. No effect.	2. No effect. 3. No effect.	1. Create 67,000 recreation day activities. 2. Provide an authentic early Oklahoma homesite of a famous frontier marshall for the enjoyment of today's generation. 3. Provide a 400-acre "natural area" for the enjoyment of nature in a rural setting which will be undisturbed by farming or ranching activities.																								

NOTE: Land treatment beneficial effects were not evaluated. Land treatment costs for all plans are \$4,619,970.

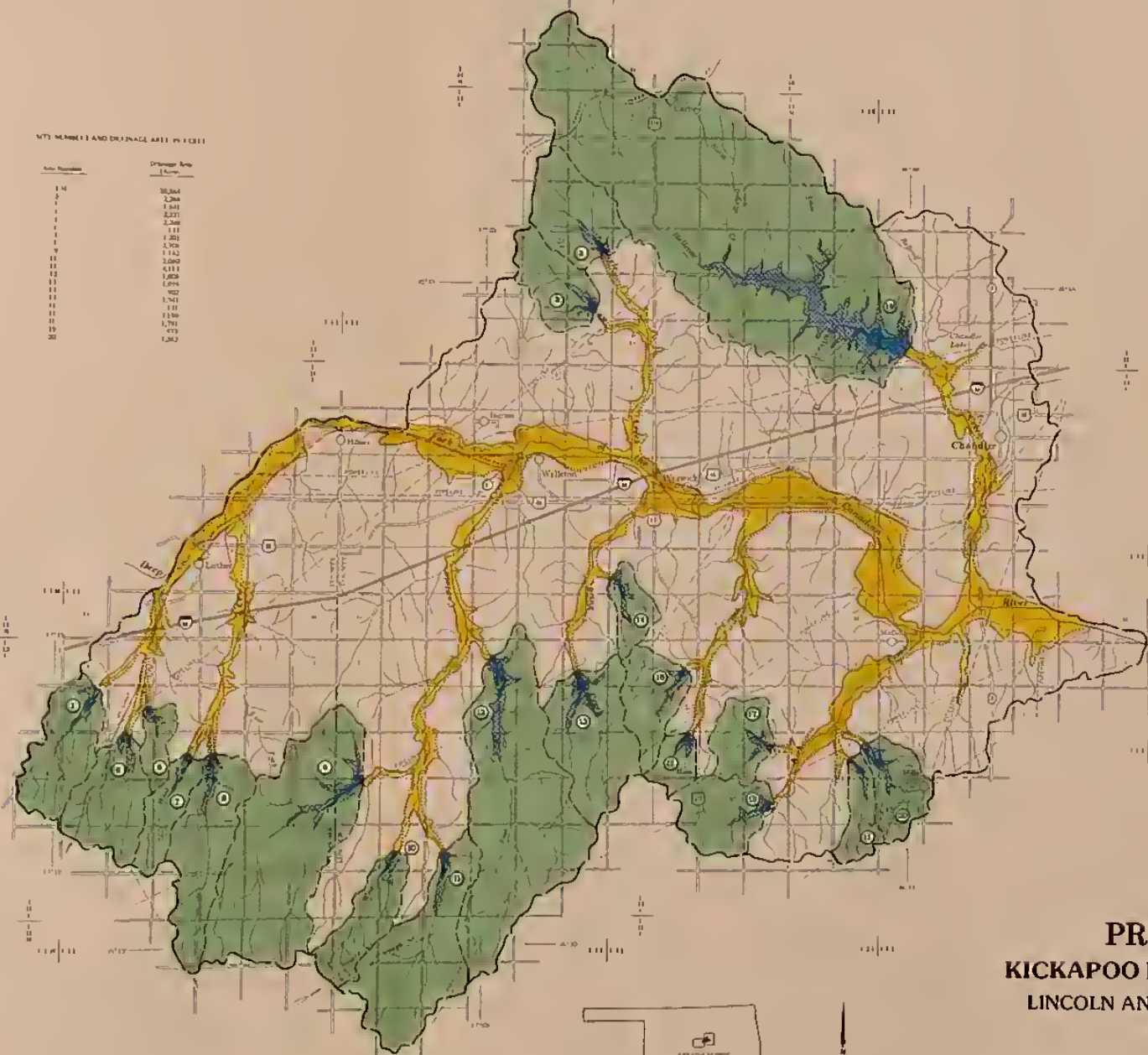
August 1977

APPENDIX C

PROJECT MAP

WATER NUMBER AND DRAINAGE AREA IN ACRES

Water Number	Drainage Area (Acres)
1	10,364
2	2,364
3	1,841
4	2,231
5	2,348
6	1,111
7	1,201
8	1,302
9	1,142
10	2,680
11	4,111
12	1,856
13	1,895
14	952
15	1,741
16	1,111
17	1,190
18	1,791
19	479
20	1,242



- LEGEND
- 1 WATER NUMBER
 - 2 DRAINAGE AREA
 - 3 ROAD
 - 4 TOWN
 - 5 COUNTY LINE
 - 6 CENSUS LINE
 - 7 RAILROAD
 - 8 DRAINAGE
 - 9 DRAINAGE AREA COMBINED
 - 10 DRAINAGE AREA COMBINED
 - 11 DRAINAGE AREA COMBINED
 - 12 DRAINAGE AREA COMBINED
 - 13 DRAINAGE AREA COMBINED
 - 14 DRAINAGE AREA COMBINED
 - 15 DRAINAGE AREA COMBINED
 - 16 DRAINAGE AREA COMBINED
 - 17 DRAINAGE AREA COMBINED
 - 18 DRAINAGE AREA COMBINED
 - 19 DRAINAGE AREA COMBINED
 - 20 DRAINAGE AREA COMBINED

PROJECT MAP KICKAPOO NATIONS WATERSHED LINCOLN AND OKLAHOMA COUNTIES OKLAHOMA

APPROXIMATE SCALE: 1 MILE

BASE MAPS FROM U.S. GEOGRAPHICAL
SURVEY AND OKLAHOMA COASTAL SURVEY
MAPS. POLYCONIC PROJECTION.

FIELD DATA BASED ON OKLAHOMA
POLYCONIC PROJECTION NORTH ZONE.





- LEGEND**
- ① PICNIC AREA
 - ② BOAT RAMP
 - ③ BOAT DOCK
 - ④ COVERED DOCK
 - ⑤ PARKING AREA
 - ⑥ CAMPING AREA



APPENDIX D
KICKAPOO NATIONS WATERSHED
CITY OF CHANDLER, OKLAHOMA
SITE NO. 1M
MULTI-PURPOSE RESERVOIR DEVELOPMENT





URBAN FLOODPLAIN
City of Chondler, Lincoln Co., Oklahoma
Bellcow Creek, Kickapoo Notions Watershed

- LEGEND**
- 100 Year Floodplain Without Project
 - 100 Year Floodplain With Project

0 1000 2000 3000
SCALE 1"=1000'

APPENDIX F

Letters of Comment Received on
the Draft Environmental Statement





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

FIRST INTERNATIONAL BUILDING

1201 ELM STREET

DALLAS, TEXAS 75270

May 12, 1977

Mr. Roland R. Willis
State Conservationist
U.S. Department of Agriculture
Soil Conservation Service
State Office
Stillwater, Oklahoma 74074

Dear Mr. Willis:

We have reviewed the Draft Plan and Environmental Impact Statement for the Kickapoo Nations Watershed, Oklahoma and Lincoln Counties, Oklahoma. The Kickapoo Nations Watershed, about 165,300 acres, extends from the Chandler area west to the Wellston vicinity. The project will provide for installation of land treatment including stabilization of critical sediment producing areas, 19 single purpose floodwater retarding structures, and one multipurpose structure (floodwater retarding, municipal water supply and recreation), and recreation facilities. The following comments are for your consideration in the preparation of the final statement:

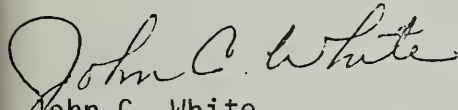
1. It is noted on page E-13 that "A septic tank and waste disposal system will be installed at each of the comfort station locations." The waste disposal system should be described, and if there is a discharge from the system, a National Pollutant Discharge Elimination System permit will be required. The quantity and quality of the effluent should be described in addition to an identification of the receiving stream in the Final Environmental Impact Statement.
2. It is stated that "Noise, dust, erosion, and turbidity of streams will increase during the construction process" (page E-2). The final statement should have an expanded discussion of measures which could be used to lessen this pollution during the construction phase. Also, the final statement should describe what means of disposal the contractor will use for waste resulting from his operations.
3. If pesticides and herbicides are going to be used, the final statement should identify the chemicals to be used, state the methods of application and give assurances that all applications will be consistent with the Federal Insecticide, Fungicide, and Rodenticide Act, as amended.
4. The provisions to be made for the collection and disposal of solid wastes should be described in the final statement.

These comments classify your Draft Environmental Impact Statement as LO-2. Specifically, we have no objection to the project; however, more information is needed to evaluate the impacts of the project on the environment. The classification and the date of our comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal actions, under Section 309 of the Clean Air Act.

Definitions of the categories are provided on the attachment. Our procedure is to categorize our comments on both the environmental consequences of the proposed action and on the adequacy of the impact statement at the draft stage, whenever possible.

We appreciate the opportunity to review the Draft Environmental Impact Statement, and we would be happy to discuss our comments with you. Please send us two copies of the Final Environmental Impact Statement at the same time it is sent to the Council on Environmental Quality.

Sincerely yours,


John C. White
Regional Administrator

Enclosure

ENVIRONMENTAL IMPACT OF THE ACTION

LO - Lack of Objections

EPA has no objections to the proposed action as described in the draft impact statement; or suggests only minor changes in the proposed action.

ER - Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to re-assess these aspects.

EU - Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

ADEQUACY OF THE IMPACT STATEMENT

Category 1 - Adequate

The draft impact statement adequately sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2 - Insufficient Information

EPA believes the draft impact statement does not contain sufficient information to assess fully the environmental impact of the proposed project or action. However; from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft statement.

Category 3 - Inadequate

EPA believes that the draft impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the impact statement. If a draft statement is assigned a Category 3, no rating will be made of the project or action, since a basis does not generally exist on which to make such a determination.



10-7-77
DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS
U.S. COAST GUARD (C-WS/7)
WASHINGTON, D.C. 20590
PHONE (202) 426-2262
JTF

• 22 MAY 1977

- Mr. Roland R. Willis
State Conservationist
Soil Conservation Service
State Office
Stillwater, Oklahoma 74074

Dear Mr. Willis:

This is in response to your letter of 13 April 1977 addressed to the DOT Water Resources Coordinator concerning a draft environmental impact statement for Kickapoo Nations Watershed, Oklahoma and Lincoln Counties, Oklahoma.

The concerned operating administrations and staff of the Department of Transportation have reviewed the material submitted. The Coast Guard commented as follows:

"The recreational use of the multipurpose reservoir indicates boater education and boating safety should have a role in the operation of this project.

"If the proposed reservoir is judged to be a freshwater reservoir as defined in 40 CFR 140, planning should consider the need for sewage pumpout and treatment facilities for the marine sanitation devices of recreational vessels.

"If boat fueling facilities are to be provided, the need for prevention and control of oil spills should receive consideration."

The Department of Transportation has no other comments to offer nor do we have any objection to this project. The final statement, however, should address the concerns of the Coast Guard.

The opportunity to review this draft statement is appreciated.

Sincerely,

J. E. COURTNEY
Comdr., U.S. Coast Guard
Department of Transportation
Public Vessel and Systems



STATE OF OKLAHOMA

State Grant-In-Aid Clearinghouse

5500 N. WESTERN

OKLAHOMA CITY, OKLAHOMA 73118

(405) 840-2811

June 10, 1977

Mr. Roland R. Willis
State Conservationist
United States Dept. of Agriculture
Soil Conservation Service
State Office
Stillwater, Oklahoma 74074

RE: 18D709--Draft Environmental Impact Statement
Kickapoo Nations Watershed

Dear Mr. Willis:

The environmental information for the above referenced project has been reviewed in accordance with OMB Circular A-95 and Section 102 (2) (C) of the National Environmental Policy Act by the state agencies charged with enforcing environmental standards in the State of Oklahoma.

The state agencies, comprising the Pollution Control Coordinating Board, have reviewed the proposed project and agree that no adverse environmental impact is anticipated. Therefore, the state clearinghouse requires no further review.

Sincerely,

Don N. Strain
Director

DNS:mt

THE HISTORY OF THE UNITED STATES

OF AMERICA



THE HISTORY OF THE UNITED STATES
OF AMERICA
BY
JOHN P. HARRIS
VOLUME I
THE FOUNDING OF THE NATION
1776-1800

THE HISTORY OF THE UNITED STATES
OF AMERICA
BY
JOHN P. HARRIS
VOLUME II
THE GROWTH OF THE NATION
1800-1860

THE HISTORY OF THE UNITED STATES
OF AMERICA
BY
JOHN P. HARRIS
VOLUME III
THE RECONSTRUCTION OF THE NATION
1860-1877

THE HISTORY OF THE UNITED STATES
OF AMERICA
BY
JOHN P. HARRIS
VOLUME IV
THE MODERN UNITED STATES
1877-1900



DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D.C. 20310

20 JUN 1977

Honorable Rupert Cutler
Assistant Secretary of Agriculture
Washington, D. C. 20250

Dear Mr. Cutler:

In compliance with the provisions of Section 5 of Public Law 566, 83d Congress, the State Conservationist, by letter dated 13 April 1977, requested the views of the Secretary of the Army on the Watershed Work Plan and Draft Environmental Impact Statement for Kickapoo Nations Watershed, Oklahoma and Lincoln Counties, Oklahoma.

We have reviewed the work plan and foresee no conflict with any projects or current proposals of this Department.

The draft environmental impact statement is considered satisfactory.

Sincerely,

Charles R. Ford
Acting Assistant Secretary of the Army
(Civil Works)





DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

OFFICE OF THE SECRETARY

WASHINGTON, D.C. 20201

June 10, 1977

Mr. Roland R. Willis
State Conservationist
United States Department
of Agriculture
Soil Conservation Service
State Office
Stillwater, Oklahoma 74074

Dear Sir:

We have reviewed the draft Environmental Impact Statement, on the Kickapoo Nations Watershed, Oklahoma and note the absence of reference to Indian families within the Kickapoo Watershed. Our information indicates that approximately thirty families of the Kickapoo, Iowa and Sac and Fox Tribes of Oklahoma reside within the area.

In addition, with regard to the increased availability of water resulting from the proposed project, we would be most interested in the potential for water district extensions for the City of Chandler to serve the rural population.

Thank you for the opportunity to review this document.

Sincerely,

Charles Custard
Director
Office of Environmental Affairs



United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

PEP ER-77/399

JUN 29 1977

Mr. Robert Willis
State Conservationist
U.S. Department of Agriculture
Soil Conservation Service
Stillwater, Oklahoma 74074

Dear Mr. Willis:

Thank you for the letter of April 13, 1977, requesting our views and comments on the draft plan and environmental statement for Kickapoo Nations Watershed, Oklahoma and Lincoln Counties, Oklahoma.

In order to more accurately address the project's effects and to avoid the appearance of bias, we believe several points are in need of further clarification. Accordingly, the following comments are made on the work plan and environmental statement for the enclosed project.

General Comments - Plan and Environmental Statement

The land treatment objective of this study effort is not clearly stated. The plans for mitigation are inadequately detailed. Our specific comments will display this.

Known mineral resources of the watershed include petroleum, natural gas, clays, and sand and gravel. The EIS acknowledges the existence of oil, gas, and sand and gravel in the watershed and states that only oil and gas are present in sufficient quantities for economic production. Both the work plan and the EIS indicate that pipelines in the multi-purpose structure site will be relocated. Neither document, however, mentions the effect of proposed construction on oil and gas production.

There are several oil and gasfields within the project area, and it is possible that the reservoirs may conflict with existing and potential production. The work plan and EIS should discuss what effect the proposed construction will have on oil and gas production facilities, including the potential for secondary oil recovery.



There is no Indian-owned trust property within the Anadrako Area jurisdiction that will be directly involved in the proposed project. There is one 80-acre tract of Indian-owned trust land situated 1 1/2 miles northeast of Warwick, Oklahoma, that is within the watershed boundaries. No accelerated critical area treatment is in the plan for this tract of land. The Bureau of Indian Affairs Branch of Land Operations has responsibility for on-going conservation and land use planning for the tract. No Indian families are involved in relocation. Accordingly, we believe the proposed work will have no significant impacts on Indian lands or interests within the study area.

The work plan should identify that the project is along tributary streams of the Deep Fork River.

Specific Comments - Plan and Environmental Statement

Page P-2

It is stated that a net of 123 acres of woodland habitat will be destroyed. The statement appears inaccurate by reason of the page P-6 statement: "About 123 acres of timber will be in the sediment pools and another 16 acres will be in the dam and spillway areas." Correction or an explanation should be provided.

Page P-7

It is stated that wildlife plantings will be incorporated in the erosion control plans of nine selected sites. The Fish and Wildlife Service should be consulted for development of these plantings at the selected sites, and the location and type of plantings should be included in the final plan.

Pages P-8, E-27, and E-45

References in the work plan and EIS citing state cultural surveys fail to mention that the Marshall William M. Tilghman homestead was listed on the National Register of Historic Places on January 11, 1976. You should address specifically whether or not there is any impact on this National Register property. If there is impact, you must comply with the requirements of 36 CFR 800.

Page P-11

Additional detail should be provided for the eight acres of mitigatory plantings proposed for the multipurpose site. As understood, the area of plantings will be in addition to the 10 acres installed for screening and improved esthetic values, (Page P-9). Clarification should be provided.

Page P-25

It is stated that grazing or other uses of the wildlife mitigation areas will be restricted. Fencing for life-of-project commitment of the mitigation measures may be construed, but should be definitely addressed.

Specific Comments - Environmental Impact StatementPage E-1

To avoid the suggestion that recreational facilities will be provided at other than the municipal site the final sentence of paragraph IV could be revised to read: "The planned works of improvement include land treatment supplemented by 19 floodwater retarding structures, and one multipurpose structure designed to retard flood flows, provide municipal water supply and water-oriented recreation.

We suggest that Section V include a statement that approximately 14,050 acres of land will receive the accelerated land treatment measures.

Misunderstanding is promoted by the statement: "Wildlife populations will become more stable in the flood plain due to fewer drownings of young and destruction of den areas by floodwaters and sediment." While stabilization of an un-reduced or even increased flood plain wildlife population can be construed, a depressed and less diverse population can be anticipated--the usual product of agricultural intensification. In addition to better recognition of flood plain changes, a comprehensive statement of upstream destruction of wildlife habitat should be provided.

Page E-2

The discussion states that 628 acres of land will be lost to agricultural purposes for 50 years. We question if it is anticipated that this land will return to agricultural use as the sediment accumulates, and if the detention action of these 19 structures will end in 50 years. The discussion on this page does not correlate with the discussion on pages E-10 and E-11, which identifies structure design life at 100 years and sediment filling time at 50 years.

Page E-7, and E-22

Although only 130 acres of timber are located in the flood-plain (E-22), reduction in bottomland hardwood loss is rated to decrease "from 500 to 200 acres per year." The discrepancy in values should be clarified.

Apparently, there will be 71,000 acres of land in the watershed without treatment. A footnote should be added on page E-7 or E-9 to state that fact and give a brief explanation of why treatment is not planned.

Page E-23

Although on E-23, the statement declares that no wetlands occur in the watershed, wildlife wetland development of 15 acres is listed on P-36. Please resolve this conflict in the final presentation.

Page E-26

It is stated that 215 surface acres of fish habitat comprised of farm ponds and the Deep Fork River occur in the watershed. The exclusion of Chandler and Warwick Lakes with their combined area of 250 acres should be explained.

Page E-27

Relative to water-based recreational developments it is stated "----a need and a potential exists for one or more such developments in association with floodwater retarding structures in Kickapoo Nations Watershed." It may be that this potential is discouraged according to the page E-12 statement because where public access is allowed, the landowner or operator will be responsible for providing adequate sanitary facilities.

Page E-28

Land treatment status is obscure throughout the documents. On the referenced page it is stated: "The 787 operators of the watershed have developed 533 conservation plans. About 64 percent of the watershed is covered by conservation agreements and about 64 percent of the land treatment measures have been installed on the land. An estimated 48 percent of all land treatment measures needed in the watershed have been applied." A listing of specific measures proposed and the percentage of each completed would be helpful and apparently consonant with your agency's Guidelines (F.R. Vol. 39, No. 107, Monday, June 3, 1974, p. 19658).

Page E-29

The proposed Arcadia Reservoir, 10 miles upstream from the Kickapoo Nations Watershed boundary, will reduce flooding along the Deep Fork River. A flood-reduction cross-section for the Deep Fork River, similar to that for the Kickapoo Nations Watershed on E-44, could be included.

Conflict between the E-48 statement of an annual benefit of \$88,410 and the P-43 benefit of \$72,150 is noted. Correction or an explanation would be appropriate.

Page E-36

Source for the comments relating to rare and endangered species should be provided. If the 1975 Rare and Endangered Vertebrates and Plants of Oklahoma which was prepared by the Rare and Endangered Species of Oklahoma Committee assisted by the Soil Conservation Service is the reference, "status undetermined" is appropriate for the least tern. The FWS listing of Endangered and Threatened Wildlife and Plants, October 27, 1976, lists neither the golden eagle nor the least tern.

Page E-38

The figure for acreage of land to be treated appears to be 14,050 acres rather than 15,050. (See pages E-7 and E-9).

Page E-39

The discussion of impacts of structural measures seems to assume that all land treatment measures are accomplished. This assumption should be discussed in this paragraph.

It is stated that many critical areas will be fenced. It is our understanding that harvesting is to be precluded, except for management purposes, as a condition for Federal cost sharing assistance. This would appear to require fencing. It would be helpful to know just how many of the 338 critical areas slated for assistance are to be fenced.

Page E-45

Although recharge to aquifers underlying the floodwater retarding and multipurpose structures may be limited as stated because of the presence of clay and shale lenses, any recharge that occurs should produce changes in ground water levels in the vicinity of the structure or impoundment. This impact should be addressed in the statement.

Page E-46

Habitat loss is incompletely comprehended in the statement: "The destruction of about 123 acres of forested range in the sediment pool areas of the structures will result in a decrease in woodland wildlife habitat---." Cropland and grassland habitat losses totaling 1575 acres will as well occur and additional direct losses will be sustained in the 103 acre area of dams and spillways and in borrow areas. Indirect losses will be attributable to the project.

Page E-47

Derivation should be provided for the "more than 800 acres" increase in wildlife habitat.

Page E-48

An annual benefit of \$56,490 is stated for changed land use. The impact on wildlife habitat, possibly adverse, should be addressed here.

Page E-52

To determine the importance of the loss of 123 out of 47,000 acres of woodland, you should identify how much is bottomland (91 out of 123) and also the total bottomland timber acreage within the watershed in order to correctly assess the impact of this loss as valuable wildlife habitat.

If more stringent regulations on the sale and use of pesticides are instituted, future agricultural chemical residue in sediment could be less than projected in the report. However, pesticide application in the watershed has increased from 1963 until now, and can be expected to increase until enforcement. Therefore, agricultural chemical concentration in the sediment would partially offset improvement of downstream water quality due to sediment trapping. The permanent decrease in downstream flow from increased crop yields, improved pasture lake evaporation, and City of Chandler water supply would appear to compound the water pollution in the immediate future. These water quality considerations should be addressed in the EIS.

Page E-53

Non-viability of the accelerated land treatment alternative alone should be better explained. The "small" beneficial effect in terms of the watershed's wildlife, which is attributed to this alternative, is noted to be a "highly" beneficial effect where land treatment is considered as part of the selected plan on page E-39.

Page E-54

Alternative 2 states that a major farm market road will continue to be flooded. It would seem that the same road would also continue to be flooded under conditions of Alternative 1.

Page E-54, & 55

On comparison of alternatives 2 and 4, the NED plan 2, provides excess benefit over cost and therefore seems superior to the chosen plan 4. The basic determinant for selecting plan 4 appears to be the elimination of inundation of a major farm-to-market road. Yet, there is no apparent gain reflected in annual monetary benefit. There appears to be less national

efficiency and no apparent environmental gains in alternative 4 through protection of the road. The rationale of trade-offs in selecting alternative 4 over 2 should be addressed in the work plan under EQ planning and not in the EIS.

We hope these comments will be of assistance.

Sincerely,

A handwritten signature in dark ink, appearing to read "Larry E. Meierotto", with a long horizontal flourish extending to the right.

Larry E. Meierotto

Deputy Assistant

SECRETARY

APPENDIX G

B I B L I O G R A P H Y

APPENDIX G

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